1299 As to any successful seepage or underflow ditch in Kansas or Colorado, I think I knew of a ditch up near Boulder, and I have been along that ditch there when they didn't connect with the river. It runs along a few feet or rods parallel with it, and the ditch filled, and they claimed that was a success. I don't know how long it continued to be a success. All I remember is that that was the plan, not to run the source of the ditch into the channel but parallel and close enough for the water to seep through.

I have no information myself of a ditch of that character being operated for two or three consecutive seasons successfully, but I told the parties about that ditch and they went up to see it before they dug this reservoir up here. I was along by that ditch up
1300 there at Boulder two or three times. That was in 1869. I couldn't tell you where that ditch was located now. I was going up there with a load of lumber and didn't pay any particular attention, only I heard them remark that that ditch didn't tap the river at all. I heard it so often that I impressed it upon these Gilbert boys who were building this ditch to go up and look at that to see if there was anything in it. Probably Boulder creek was the river they ran this ditch parallel with. It was drained from the stream into this ditch. It probably ran along from ten to fifteen feet—a rod or something like that—from the river.

1301 There has been a great deal more of the outlying country along the drainage of the Arkansas river in this county broken up and put into crops than there was ten or fifteen years ago. I think that has had a good deal of influence on preventing as much run-off into the river. In the last ten years I think the river has shrunk fully one-fourth. I think it has lowered it in the winter too. I don't think we have near the water in the winter that we used to have. I couldn't answer as to any particular or exact years. I have just noticed that there has been a general decrease in the water.

Cross-examination.

By Mr. CAMPBELL :

1302 The South Side ditch heads about nine miles above Dodge City. I know of the ditch called the Soule or Eureka ditch;
1303 it heads approximately twenty miles above Dodge City. The South Side ditch is always referred to locally as the South Side ditch. The water-shed of the Arkansas river between here and the State line is from ten to fifteen miles wide on an average. I think there are quite a number of places between here and the Colorado State line where reservoirs could be built without much expense.

Cross-examination continued.

By Mr. DAWSON:

1304 The water-shed I spoke of is the immediate drainage shed to the river. I don't mean to include in that the streams
1305 which run into the Arkansas river in this State away below. If I did the drainage would be much wider.

I am probably familiar with the values of farming lands in Ford county in a general way. The improved bottom lands along the Arkansas river in Ford county sell at this time for I should
1306 say thirty dollars an acre on an average. There are unimproved lands on the bottom which are in native grasses.
1307 The uplands bring on an average about three to five dollars an acre in this county, I should judge. There are many wind mills operated in this county. They pump the water out of the ground. There are quite a number of them along the valley of the Arkansas river in this county. I should judge there are three hundred active wells in the county anyway. Practically every farmer has such a well, and the wells are pumped for the purpose of
1308 raising water for domestic purposes, including the watering of stock. The city here draws its supply of water from wells sunk in the bottom land. The Santa Fe railroad also has a pumping well and plant in the vicinity of this city on the bottom of the Arkansas river.

This is a town of about three thousand inhabitants.

Redirect examination.

By Mr. SMITH:

The supply of water for these wind mills and the Santa Fe Railroad Company and the water-works, I shouldn't say that it had been increased on account of the underflow. They have been increased.
1309 This may have been on account of the demand for water, but it is probably on account of the shrinkage of the underflow wholly that their capacity has been increased. I don't think there is as much water now to supply these wind mills from, and the railroad company and the water-works, as there was before the underflow had been lowered. The productiveness of these bottom lands has been certainly decreased because of the lowering of the underflow. The value of these lands has been decreased for the same reason. If there has been a rise in the price of these bottom lands it is not because of the lowering of the underflow.

(Objection.)

1310 The South Side ditch, to the best of my knowledge, dried up because of the falling off of the underflow. The immediate stoppage of the ditch was caused by the surface water being turned in from the river, but that was never the cause of the ditch drying up. It only filled a short distance of the ditch with this overflow

which previous to that would seep in and furnish water for the ditch. (Objection.)

1311 In my evidence yesterday I don't think that my estimate of the falling off of the river was strong enough. I think that there has been a decrease in the water of more than one-

1312 quarter in the last twenty years. (Objection.) The conditions for raising alfalfa on the second bottoms as the river flows now are not nearly so good as they were years ago.

The Eureka ditch is now deserted and it never ran more than two or three years. The water gave out at the source. After they commenced digging the ditch they prosecuted the work continuously until it was completed. That is my recollection. It is my recollection that as soon as they had obtained their charter they went on with the work as fast as they could, (objection), and

1313 the work was continued from the time they first commenced. (Objection.)

I think there are about five hundred inmates at the soldiers' home at the present time.

Recross-examination.

By Mr. DAWSON:

Q. You have given the reasons for the failure of the South Side ditch to run water. Is it not true that after the river washed in there and filled up the reservoir and the ditch with muck and mud that the company was out of money and never did clean it out, and did you not say that you knew it at the time?

A. No, sir, I did not.

Q. You never knew of them spending any money on it after that, did you, to put it in shape?

A. They didn't on the source of the ditch or reservoir, but my recollection is that they extended the ditch farther east after that.

1314 The Eureka ditch didn't wash out near its head by recent floods in the Arkansas river to my knowledge. It probably had a number of breaks in it along its course. I know of some. It was fixed up in first class shape—boarded. The embankments on the lower side of the ditch were plank. I think the line of the ditch was a practicable route for the ditch. They irrigated probably eighty or a hundred acres all together under it, that is, under the South Side ditch, not under the North Side ditch. They

1315 irrigated approximately probably ten thousand acres along the line of the North Side ditch. I think they used the water for two or three years. I think ten thousand acres would be the maximum of what they irrigated. That is my judgment. I don't know, but just as a casual observation in riding over the country.

As to these wind mills, I have known of some on my place that couldn't get all the water they could pump with the level the water has now, but to go down farther two or three feet you could

get the water. The water has never failed us yet. Three or four feet is as far as I went. I put two mills down there three or four feet
deeper than formerly, I think. I got plenty of water, and
1316 just as much as I ever had. I never failed.

Mr. Ashbaugh on behalf of the complainant introduced in evidence chapter 425 of the Session Laws of Kansas, 1901, found on page 766, reading as follows:

"Senate Concurrent Resolution No. 14.

"Relating to the Diversion of the Waters in the Arkansas River in the State of Colorado.

"Whereas, it is a matter of common notoriety that the waters of the Arkansas river for some time past have been and are now being diverted from their natural channel by the State of Colorado and its citizens to the great damage of the State of Kansas and its inhabitants; and

"Whereas, it is threatened not only to continue but also to increase said diversion; therefore be it

"Resolved, by the senate, the house concurring therein, that the attorney general be requested to institute such proceedings and to render such assistance in other proceedings brought for the same purpose as may be necessary to protect the rights and interests of the State of Kansas and the citizens and property owners thereof."

(Objection.)

1318 L. J. PETTIJOHN, Dodge City, Kansas.

Direct examination.

By Mr. LOOMIS:

I live at Dodge City and am receiver of the United States land office at Dodge City, and have been such receiver for six years. My office has jurisdiction over the southwestern part of the State, about one-quarter of the State. The Arkansas river runs through that portion of the State which is under the jurisdiction of the land office
at Dodge City. As such receiver I am in possession of the
1319 books of the office, showing the Arkansas river between the Colorado State line and the west line of Cowley county. I have examined these records for the purpose of determining the character of the Government survey along the Arkansas river in a part of this district. These records show that the surveys of the lands were made up to the river banks on each side of the river; (objection), that is, that the Arkansas river through this district is a
meandered stream according to these Government surveys.
1320 The width of the river is given at some of the section lines. The land on one side is surveyed separately from the land on

the opposite side. The section lines do not run across the river, and the survey runs up and down the banks of the river on either side. The land along the Arkansas is surveyed in fractions or parts of sections, which are called lots, and these lots run to the river banks. This is true, that the Arkansas river is meandered on both banks through all the lands in this district. The plats showing the manner of this survey were made by the Government. I have some of them here. I have the map showing a part of township 26,
1321 range 20, and of township 25, range 19, and of township 22, range 16. The maps that I have here are a correct copy of
1322 the Government map on file in my office at this place. All the other maps are similar to the maps which I have just identified, I think, and are correct samples of all the other maps on file in the office showing the location of the Arkansas river and the character of the Government survey through the district. These sample maps show the Government survey of streams that are not meandered. One is called Bluff creek, in township 33, range 20 west, in Comanche county. The section lines of these streams run across the streams and the survey includes the stream. The plat shows no attention was paid to the stream in the making of that survey. (Objection.) These maps that I have identified are fair samples of the Government maps on file in my office so far
1323 as they purport to show the Government surveys along streams which have not been meandered, so far as I have observed. (Objection.)

(Complainant's Exhibits A–9, A–10, A–11 and A–12 offered in evidence. Objection to Exhibit A–12.)

1324 All the maps in my possession show the meandering of the stream the same as the maps which have been introduced in evidence. (Objection.) They are similar to these. The Arkansas river through my district was meandered by the Government in making its survey along the banks of the river on either side. A Government lot of land is a fractional part of a quarter. The lot in making up a survey is located along the north and west sides
1325 of the townships and along the river; that is to say, where the stream is meandered. Wherever the river is meandered the fractional quarter sections along the river for convenience are divided into lots where they show more or less than forty acres, but if it is an even forty it is not called a lot. In making the Government survey the lots are not shown along streams that are
1326 not meandered, where the survey crosses. The length of my district is about three hundred miles, and the district is
1327 about seventy-five miles wide. The north line of the district is the north line of Hamilton, Kearney and Finney counties, and on the east the north line of Barton and Pawnee counties.

Cross-examination.

By Mr. HAYT:

These three exhibits that were selected from the plats in my district were brought over here by the attorneys. They asked for surveys in this county and other counties near. These were not all the plats of which we had copies in our office at the time. We have a number of copies here, but I don't know how many apply to the river townships. I don't know of any particular reason myself why these were selected instead of others. The word "lots" is a
1328 customary designation in other instances, particularly with reference to the excess over a township or the lack of land to fill out a township. It is used on township lines and the river.

Redirect examination.

By Mr. LOOMIS:

I am willing to produce for the benefit of counsel for Colorado and for their inspection all copies of plats in my office. They
1329 are welcome to all of them. My recollection is that in selecting these sample maps they only wanted one or two for a county, and as good a selection was made as possible, to show the Government surveys through these different townships in different counties. The width of the river as shown by these maps,
1330 taking the north side of section 29, 26–20, is 1,419 feet. (Objection.) The average width through the whole town-
1331 ship is over 1,500 feet as shown by Exhibit A–9. The aver-
age width of the river as shown by Exhibit A–10 is 1,584
1332 feet. The average width of the river through the township as shown by Exhibit A–11, is very close to 1,400 feet.

1334 The Government surveys west of Dodge City were made in 1871 and completed in 1873, as shown by the maps already introduced in evidence and others that I now produce.

1336 The width of the river here straight across is about 1,500 feet, and the average width through that township is between 1,300 and 1,400 feet.

1337 At the southwest corner of section 2, 21–15, the width of the river at its narrowest point is 1,616 feet, and the average width of the river through that township is between twelve and thirteen hundred feet.

1338 All of these plats now exhibited show the meandering of the Arkansas river, and in respect to the meander of the river they are the same as the plats which were introduced in evi-
1339 dence. All of these plats which show the Arkansas river show the meandering of that river.

Recross-examination.

By Mr. HAYT:

1332 These averages are about the same as the average width of the river shown upon the other plats similar to those to which
1334 I have testified. These additional maps do not cover the territory west of here. Township 26 south, of range 20 west,
1335 is located—I think it is the southwest corner township of Edwards county. It is about twenty-five miles east from Dodge City. The width of the river as shown by the plat as
1336 it enters that township is 1,239 feet. Where it strikes the Osage land here it is just about the same width. At the
1337 northwest corner of section 31, 21–15, the plat shows the width of the river at its narrowest point to be 1,056 feet. At the northwest corner of the northeast quarter of section 31, township 21, range 15, it is about eight hundred feet. Eleven of these
1337 other plats which I have brought in here show the meandered stream. The following townships and ranges are embraced
1338 within those eleven plats: 24–18; 23–18; 20–14; 21–16; 22–17; 19–13; 25–20; 24–19; 19–13; 20–14. There are ten of these all together and one of them is a duplicate. All these townships exhibited upon these plats are south of range 15, west of the sixth principal meridian. Speaking of all these plats, I mean
1339 these ten plats last referred to.

Cross-examination.

By Mr. CAMPBELL:

1333 The survey shown in Exhibit A–10 was made in August, 1871. It was for Edwards county, which lies east of us. I don't know when the Government survey was made in these western townships. Approximately, however, some time in the '70's. The public survey was extended over the lands east of here before
1334 it was extended over those west. Approximately there are more than six hundred thousand acres of public land in this district.
1335 I stated that the records in my office show that the Arkansas was meandered to the dividing line between Colorado
1340 and Kansas. There is occasionally some public land being taken up in this district, most of it in the western part. This land is being taken up under the homestead act.

1341 H. B. BELL, Dodge City, Kansas.

Direct examination.

By Mr. LOOMIS:

I have lived in Dodge City for thirty years, and have been acquainted with the Arkansas river during that time. I came here

in 1874. During the last ten years or fifteen years there has been much less flow in the river, with the exception, I think, of one or two years, than during the first ten or fifteen
1342 years that I lived in this county. During 1872 or 1874—one of those years was very dry. I would think that during the recent years there is not over one-tenth of the amount of water that there was in the earlier years, barring the rises and the floods, in the river. During the first ten years at normal times there was a good flow of water all the time—a foot to eighteen inches—and the river was wider than it is now, with the exception, I think, of about two years, as near as I can remember. During the early times the current of the water flowing in the river was nearly the entire width from bank to bank and would be from twelve to eigh-
1343 teen inches in depth. As to the average flow of the river now during most of the year, it don't flow most of the time, excluding the time of high water and freshets. It is almost dry. There is just a little stream—very little. It is almost dry. It is a much narrower channel now than it was. It has drifted in. The average width of the channel of water flowing in the river at the present time I wouldn't think generally over eight or ten feet and from three to seven or eight inches in the bed of the channel, in depth. When it does flow at all it is six or eight feet wide. A good deal of the time it don't flow at all, and it is hard to estimate that, because there are places it comes like a spring and you go up two or three miles and it is dry. We noticed this falling off in the flow of the river I would say about twelve to fifteen years ago.

Cross-examination.

By Mr. DAWSON:

1345 I remember the time when the people of Kansas talked about the rains moving west so they could raise crops farther west, and they still talk about that. I don't remember when this talk commenced. I suppose when the land agents opened their offices was about the first talk we had of it. They were probably the originators of the notion. I think along some where in 1884 or 1885. I think the rains in this locality are better distributed now so that crops are more certain than they were in the earlier years.

I first noticed the shrinkage in the flow of water twelve to fifteen years ago, and it seems to have been getting less most of the
1346 time since. I can't say that I noticed any falling off between 1874 and 1884. If there was any shrinkage I didn't notice it. One thing that always called my attention to the river more than anything else, we generally had a toll bridge here. We couldn't ford it without a double team.

I have never noticed that the native grasses here show a falling off as the country becomes well settled. Our uplands have been grazed so heavily with cattle, and then there are so many cattle

shipped to this point and unloaded, they have eaten the grass
1347 off. I think they pasture nearly all of this native hay land here. It is not very often that the native meadow hay is allowed to go to seed. After the hay is cut off in the summer the cattle are put on and allowed to pasture it in the fall and winter. I think that would deteriorate the grass or hay that would grow upon a given number of acres somewhat. It would make it surface-bound and hard. I think is cramps it. I think that would hurt it some. I think the falling off in the native hay crop is due to both causes. I couldn't say what percentage is due to each. The river bottoms do not cut near the hay they used to. I think, though, it may be more from the overcrowding of cattle, and the river going down also. I don't know how near the surface of the grass land the water needs to be
1348 to make a good crop. I know there is a falling off of pretty nearly one-half, caused, I think, by the water going down, and to its being tramped by the cattle. There is not much alfalfa on the first bottom as on the second bottom. Alfalfa is a more profitable crop than native hay. Where I have noticed alfalfa on the first bottoms the crop is generally good. I have never
1349 noticed that the water has sunk to a greater depth below the surface than it was formerly. I think, though, that the underflow would leave as the river goes down. I have made no investigation of that and I have no accurate information on the subject. They have been putting in new ground in crops in the last thirteen years. There has been probably twenty-five to thirty per cent. increase in acreage in the last fifteen years.

1350 As to the run-off of rains being affected by the lands being put under cultivation, I think that depends upon whether the lands are level and whether it is a dashing rain. I guess that ploughed land would absorb more water. It would take it in better than that which has sod on it. I think that follows everywhere. This might affect the river very little, probably.

1351 I know there was a dry year somewhere about 1872 or 1874. My recollection is that one of those years the river was nearly dry. The river was not quite as low that year as it gets of late years. I thought it was dry in 1872. In 1874 it was very dry, I think. I don't remember any dry years in the '80's. It was very low in 1874, is my recollection. We generally have a
1352 June rise here in the river. We had several rises this year. We don't have them every year, as much as others, but we do have a rise about two or three times every summer. The rise does not last very long unless we have a cloudburst or something along the river. It runs out pretty quick sometimes. It comes low water and then there will be a cloudburst from another direction and it comes up again. I would think the usual period of duration of such rises would be from five to ten or fifteen days, somewhere along there.

1353 I am in the real estate business, but do not pay very much attention to it. I don't think farm lands are quite as high on the average as they have been at some times in the past. They are as high except during boom periods. In 1885 and 1886 there was a boom. In 1896 the lands went down to nothing almost. They started up again two or three years ago, I guess, and they have been going up ever since, gradually. The low lands are worth from ten to fifteen dollars an acre. The alfalfa lands are worth the most. Alfalfa is mostly grown on the second bottom. The second
1354 bottom is higher than the first. The uplands are worth $4.50 to $5.00 per acre. I think alfalfa lands are worth about $30 an acre—from $20 to $50 an acre—and the native grass lands about $10.00 an acre. Twenty years ago there was not any crops raised or planted. The country has been very successfully farmed of late years—more profitably of late years than before.

Redirect examination.

By Mr. LOOMIS:

1355 My idea is that the lowering of the underflow has lessened the growth of crops on the bottom lands along the river. (Objection.) In my judgment the bottom lands along the Arkansas river would be more valuable if the underflow were as high
1356 now as it was when I first knew the Arkansas river. In my judgment the existence of the underflow adds to the productiveness and value of the bottom lands. (Objection.) Since I came here the population of the county has increased, and it has increased also on the upland. The main crops raised on the uplands are wheat, oats, barley and kaffir corn, and upon the bottom lands are native hay and alfalfa.

1357 I referred to the toll bridge. We could hardly ford the river most of the time without doubling teams and getting in the water and sand, and it would cost a dollar to cross the bridge, but everybody preferred to pay the dollar rather than get into the river. I think this was in the summer time and during the growing season. Now you can cross the river most anywhere. They can ford it at home and all around.

1358 S. GALLAGHER, Jr., Dodge City, Kansas.

Direct examination.

By Mr. LOOMIS:

I have lived in Dodge City since April, 1877. I have been acquainted with the Arkansas river, I might say, continuously. I am city clerk at the present time. I have been clerk of the district court. From my place of business the river is in sight at all times. The flow of water in the river has been unquestionably less in the

last few years than it was during the first years I was ac-
1359 quainted with it. It has been unquestionably less for ten or twelve years. This has been so pronounced that it has been the general talk and conclusion of everybody that we didn't have the water we used to have. There is not, I will say, a quarter of the amount that there was formerly when I first knew the river. When my attention was first directed to the marked diminution in the flow of the river was when the Eureka canal had to quit business on account of the lack of water in the river. My recollection is
1360 that they had water in the canal for possibly two years. I don't know how far down the canal the water flowed, but we had plenty of water here in the canal. The canal tapped the river at Ingalls. The water didn't flow down into the canal because there was none in the river. We generally get a small June rise here, but nothing in comparison to what it formerly was, and then we are depending almost entirely upon local conditions. The flow of the river don't last any length of time at all. There is no water to
1361 amount to anything. There would be water in the river a little ways at times. The local conditions I spoke of were local rains, cloudbursts and such things as that that they have west of here and through here. The June rises now don't last as long as they used to and there is not the volume of water that we used to have. In the early years, I can't tell you definitely, but my recollection is that after the June rise we generally had a good stage of water in the river for—oh, possibly six weeks or may be two months. During the last ten years we haven't had the volume of water we used to have. The effect of the June rises on the bottom lands was to increase the vegetation. It raised the underflow above the normal condition and gave life and vigor to the hay lands along the bottom. We didn't have much alfalfa at that time. It thoroughly saturated the adjacent lands, and this added to the product-
1362 iveness of that soil. (Objection.)

I was acquainted with the South Side ditch. Its source of supply was from the underflow. I have no knowledge of its being cut off until after the reservoir was filled. (Objection.) It was filled because of a freshet and the river ran over its banks and filled it full of black muck and stuff that comes down with the freshet. This filled the reservoir. There had been a supply of water in the ditch before the reservoir was filled. There was all the
1363 water they could make use of. I should say that the supply of water was for the first nine miles at least, and for that distance there was a sufficient supply of water for all their wants.

Cross-examination.

By Mr. HAYT:

This year we have had considerably more water than usual for the last six or seven years—one-third more I should think. This

year has been a kind of an extraordinary year. I can't say
1364 what time the water came up in the river this year. I believe it came up seven or eight weeks ago. It was some time in June, about the first of June, I believe. There has been some water in the river ever since that time. I have been across on the bridge several times. There is a good deal more water than usual in the river. At my usual point of observation, and that is at the stables of the fair association, it has frequently been from bank to bank, but the banks there are narrower than almost any place else along there. There is an island in the center and that throws it on each side.

1365 Q. Has the river been at these times of high water since the first of June a thousand feet wide? By the river I mean the water.

A. That is, you mean the average?

Q. No, I mean at the highest.

A. At any time?

Q. Yes.

A. Well, I suppose the banks—there are places that distance from bank to bank.

Q. At those times how deep has the water been in the deepest part of the channel?

A. Oh, I don't know.

Q. As much as three or four feet?

A. The channel changes with every freshet.

Q. Now, when the river is at its highest how deep, in your judgment?

A. Oh, three or four feet.

Q. And from that it thinned out until it got beyond the channel the greatest distance?

A. Yes, sir.

It is not true that the river has been practically the height I have just described since the June rise up to the present time. I can't say as to how much of the time it has been as high as I have described it. I have been surprised with the river staying up this year as long as it has. I account for it by the rains we have
1366 had. In the earlier years the river usually had about the volume of water that we had this year, or more, all the time. I can't say as to the river being low in the month of September in the earlier years. Sometimes it would go down. I have seen it when there was but very little water. I have seen the river dry at this time prior to 1891, so that there was practically no water running in it. I believe that was in 1878. I have no recollection of any other year. I was not on the river in 1874. I was in Illinois. I came here in 1877. The amount of land
1367 under cultivation in crops has more than doubled along the Arkansas river in this vicinity since I first came here in 1877. (Objection.) Where they have the benefit of the underflow I believe that the principal crop is alfalfa, the most profitable crop, and then

they try to raise kaffir corn, sorghum, wheat, oats, barley, rye,—I expect there is more acreage put into wheat than into any other crop, and next to wheat is kaffir corn and sorghum, for for-
1368 age. (Objection.) Wheat is usually raised here upon the uplands. (Objection.) There is quite a lot of wheat raised on the bottom lands. As to the value of lands, the second bottom and the bottom lands are generally together. (Objection.) The bottom lands are more valuable than the uplands. (Objection.) I don't know that the bottom lands contiguous to Dodge City
1369 have advanced much in value except those seeded down to alfalfa. (Objection.) Such lands right close to Dodge are worth more than those out West where they have to feed it on the ground. I don't believe that I am sufficiently familiar with the value of these lands to give the market value.

These ditches that were built here were built to supply water for agricultural purposes. I won't say that it was determined about that time that crops could be successfully grown here without irrigation. No, sir. They could doubtless be grown a great deal more successfully with irrigation than they could without it.
1370 There was one or two years about the time these ditches were started that farming was about the most successful out on the uplands or as successful as we have had. They raised some crops for two or three years. My recollection is that it was along in 1885. The parties that were here on the upland generally came out to get the benefit of Government land and put a good big mortgage on it and they got homesick and left. What crops they undertook were a failure, but there were very little crops put in the way they do now. In that early day there were good farmers here and poor farmers, and the good farmers are still here, and the good farmers raise good crops now generally, usually, and the poor farmers fail.

1371 I said that when the underflow was raised above the normal it was a benefit to the meadows. I have a theory about the underflow, and that is that it is not dependent upon local conditions at all, excepting to raise it above a normal condi-
1372 tion; that it don't lower it below the normal. I have made inquiry of parties that had wells that were supplied with water from the underflow and found that there was no draught that they could make from those wells that had any perceptible effect upon them, and there seemed to be an inexhaustible supply of water at all times where the underflow was pronounced. (Objection.) My opinion is based upon some other facts that have been told me by parties that have made investigations, and that opinion is that the underflow has a diurnal tide. Twice a day it has a perceptible rise and a perceptible fall, and its supply is something I don't know anything about. I never went that far, but I do not believe it is dependent upon any local rises. I believe it is there. The
1373 farmers up and down the river here largely have wells worked by wind mills. The city of Dodge City is supplied

with water for domestic purposes by a water-works system pumping water down on the bottom, up the river from where we now
1374 are. The Atchison, Topeka and Santa Fe railroad gets its supply of water here for railroad purposes by pumping. They have a well sunk down to another stratum of water that is on the north side here. It is pumped up by steam. I don't know the depth of this well.

Cross-examination.

By Mr. CAMPBELL:

1375 The head of the Eureka canal is about twenty-six miles above here. After it was finished it conducted water from the river and there was a sufficiency to fill the canal. This lasted for a couple of years.

I saw them using water from the Eureka canal east of Spearville, sixteen miles east of here and about forty miles from the head. The ditch seemed to be carrying all that they wanted. I saw
1376 this about a year or eighteen months after the ditch was completed. I don't know when they began the ditch; they must have been one or two years at it.

1377 H. D. CHAMBLISS, Dodge City, Kansas.

Direct examination.

By Mr. LOOMIS:

I have lived in Ford county since 1872. My place is on the Arkansas river, three miles east of Dodge City. I was seven years old when we came there in 1872 and have lived there continuously ever since. The flow of the river during the late years has been less (objection) than it was during the first years that I knew it.
1378 I don't think that the volume throughout the year would be one-twentieth of what it used to be when I was a lad. I should judge that this change in the flow of the river became noticeable twelve or fifteen years ago, along about that time. During the early years we always had a good big channel of water, I should judge anywhere from four to five hundred feet wide, and it ran from a few inches to about three feet, in normal times, and would generally reach very nearly from bank to bank at the normal times. I was on the river almost all the time. I used to hunt and fish and herd cattle. My father was a stock man at that time. I
1379 never remember seeing the river dry until along I should judge ten or twelve years ago. That is, when the river would become dry so that we could walk across it without getting our feet wet we noticed it more particularly than we had before. With the exception of this year, for the last ten years I am almost sure it has been perfectly dry every year from a month to four or

five months. I have known it to be dry from the latter part of June clear on until it would start in November. This has been the usual and ordinary condition between the months named for the last ten years, I am sure, excepting this year. (Objection.) I am familiar with the rises that occur in the river. I have two fences that I have
to keep across the river on account of my cattle and I have to
1380 watch the rises closely. There is nothing positively regular
about them. We generally have a rise in June and we always get it from a washout. I don't think we ever have any real June rise any more. In the early days we always counted on the June rise as regularly as the seasons came. This continued until about ten or twelve years ago. Since that we haven't considered that we had any. In fact I watched the wires and would never remove my fences only when I got news of a rise that would come from rains in the mountains. The river usually in former years came up gradually about the middle of June and the volume increased gradually for a week and it would come sometimes so that it would get out of its banks a very little, and it would go down gradually for three or four weeks until it got down to a normal stage. It is nothing like
I spoke of before. There are five or six weeks I should
1381 judge that it would be what we might consider high, that is,
above the normal. That condition lasted down to about ten or twelve years ago.

Cross-examination.

By Mr. DAWSON:

I have a farm of about five hundred acres here on the river bottom. I farm the land and pasture some of it and have some of it in alfalfa. I also have some upland. All my hay land is on the bottom. The alfalfa is on first and second bottoms. The best is on the
second bottom. The first bottom is the better native grass
1382 land. Alfalfa land is the most valuable. I can't say about
the water in the river in 1874. I don't remember anything about that particular year. I don't remember anything scarcely
1384 about the river until I was about eleven or twelve years old.
I think the winter flow has been of late years about one-half as great as it used to be.

I think there is a great deal more country along the Arkansas river under cultivation now than when I first knew the river. Of course ploughed land will absorb the water more than ground that has not been ploughed. It doesn't run off as fast. My place is on both sides of the river. There is a creek on the south side lying ten or twelve miles south of the river and running parallel to it for twenty-five or thirty miles, called Mulberry creek. The source of
that creek is on higher ground than the river. It runs into
1385 the river east of my place about fifteen or sixteen miles. It
is not a running stream all the year round; it only runs near the mouth of it for a few miles, and there it runs the year round.

My land is between the river and the creek, and at my place the creek is about nine miles from the river, south. As you go back from the river in either direction south or north the country gradually rises from the river.

Redirect examination.

By Mr. LOOMIS:

1386 In the early days I used to through the summer very frequently be able to go to the river and catch a mess of nice fish. Everybody fished in the river more or less at that time. In recent years we don't have any fish unless the river stays up a long time.

When we came here the population in the county, outside of the soldiers at the fort, was possibly a hundred permanent residents. The population of Ford county now is something like seven thousand, and of Dodge City something like three thousand.

1387 They began to settle along in the bottoms in 1872 and 1873. The bottom lands were settled up before the uplands. I have a well that I have examined frequently since it was put down eleven years ago. When I put the well down—it was for irrigation purposes—it was ten feet, lacking a couple of inches, to the level of the water when the pump had not been running. We measured it at the time we put the well down. A year afterwards we noticed that the water was lower and we measured it again and it was nearly eleven feet to water, and the well now at the present time is right at twelve feet to water. This well was dug, as nearly as I

1388 can remember, in 1893. It is about half a mile from the river. I have noticed that the river banks are higher to the sand bed than they used to be. I have noticed that it is farther to water—to the underflow as we call it now—than it was when we first put that well down. I have noticed when the river would come up, very frequently, holes that were below the level of the river at normal times when it would seep up, how they became two or three feet deep where there was just little water. (Objection.) I

1389 know one hole in particular on my place that is three or four hundred yards from the river. The condition I have just described is still true. When the river rises the water comes up in that hole.

Recross-examination.

By Mr. DAWSON:

The well I have spoken of was dug in 1893 and it was ten feet to water, lacking two inches and a year later it was eleven feet to water, or very nearly, and now it is nearly twelve feet; I think it

1390 lacks 3 or 4 inches. This is an open well, and I use it every day. The water is pumped up with a wind mill. I have never noticed the water fluctuating in this well from day to day or

week to week when it was being pumped. There seems to be no limit to the water in the well. This well has a milk house over it and it is covered up and I have to go down and see how the well is and it is very rarely we notice it, only when we go down to fix the pump. Nothing has ever been done to the well since we put it down.

1391 The holes I have spoken of are holes along a depression where there is a slough, and the slough would indicate that there has been an old channel of the river along where the slough runs, and these holes show a rise and fall of the water as the river rises and falls, and if the river rises high enough it will run water over the surface into the slough. There has been a large increase in the number of wells operated by wind mills in this county in the last ten or twelve years. Every farmer in the bottom has from two to four. The water is pumped generally for domestic and

1392 stock purposes. A few use it for irrigation. I use my well to irrigate a garden of about an acre. I can pump water enough with this wind mill to irrigate an acre and water all the stock. I suppose there are more than three or four hunderd wells running by wind mills in this county. I expect there are five or six hundred of them.

1393 M. W. SUTTON, Dodge City, Kansas.

Direct examination.

By Mr. ASHBAUGH:

I have lived in Dodge City since the last days of May, 1876. I am a lawyer, and am acquainted with the Eureka ditch. I was attorney for it for several years. To the best of my recollection that ditch was begun in 1882 or 1883. The preliminary survey might have been made before the charter was taken out. Actual work on the construction of the ditch was begun soon after the charter was taken out, and it continued on until the ditch was completed.

1394 This work was continuous. To the best of my recollection, the water was turned into the ditch in 1885 or 1886, and it continued to run in the ditch until 1889 and then there was no more water, because the water in the river gave out. The preliminary survey may have been made a month or six months before the charter was taken out. That ditch is now absolutely dry and has been since 1889, except four or five miles at the head of it, and that has been used as a ditch ever since when there was high water in the river. During normal stages of the river there has been no water in the ditch. The river is dry. There is none running. My recollection is that that ditch was forty feet wide in the ground where it is dug, saying nothing about the banks made by throwing out the dirt. I couldn't tell exactly how deep the water was in it,

but I think it was about three feet. It was about a hundred
1395 miles long. My recollection is that the plats show ninety-six miles of main ditch. It tapped the river near Ingalls in Gray county and emptied into Coon creek in the eastern part of Ford county, and Coon creek enters into the Arkansas river near Kinsley.

Cross-examination.

By Mr. HAYT:

I think this ditch went dry in 1889 because there was no water in the river. It might have gone dry a year earlier. I presume its going dry was a matter of discussion among the officers of the company and others, but I don't recollect any discussions now; it is a good while ago. At that time it was attributed to taking this water out of the river above in Colorado for irrigation, and some talk was had about the ditch commencing an action in the United
1396 States court to restrain those ditches in Colorado from taking the water. That was as early as 1889, if not a little earlier. Nothing was done towards bringing a suit, and the ditch was practically abandoned and closed up, unless it is those few miles at the upper end of it, and the neighbors I understand just use that without regard to its ownership or anything. I don't think the people here at Dodge City think anything much about this water question one way or the other.

Cross-examination.

By Mr. CAMPBELL:

1397 The cost of the Eureka ditch ran up into the hundreds of thousands. How much I would not be able to say. I only know from what I was told, that it was close to three hundred thousand dollars. The Soule ditch was built for the purpose of irrigating land. It is fair to assume that irrigation in this vicinity would make the fields yield abundantly, whereas they do not yield anything now but grass, and this was the purpose of constructing the North Side ditch on the Arkansas river, for which ditch I was the attorney. It was the understanding in this vicinity that if you could get water on these lands for irrigation it would increase the annual production. That was the belief of the people who constructed the ditch and the people who lived here. It was generally believed in this country that if we could get water on these lands here by irrigation it would increase the production of crops.

Cross-examination continued.

By Mr. HAYT:

1398 The original name of the company that constructed this ditch was the Eureka Irrigating Canal Company. The name

was afterwards changed, and I can't give the new name. I acted as attorney for both companies. The officers of the company talked with me with reference to the diminution of the water in the river and its total failure, and it is my recollection that the cause assigned was the irrigating canals in Colorado exhausting the supply of the river. I advised them in reference to that. I advised them that they were the prior appropriators and that I believed if they would commence this case in the United States court the ditch companies of Colorado that had been taking out water since they had taken out that ditch here and were using water could be restrained from taking out water to the detriment of this ditch. I don't
1399 think the question of the statute of limitations was discussed to any extent. But when the water commenced to fail that subject commenced to be discussed by the ditch company, and I advised proceedings of the kind mentioned to prevent their taking the water out, but no such proceedings were begun. I presume that I had in mind at that time that if suit was not properly commenced at that time it might be barred by laches or by the statute of limitations, but I don't recollect that I did have that in mind.

1400 GEORGE C. LAIRD, Dodge City, Kansas.

Direct examination.

By Mr. ASHBAUGH:

I live seven miles west of Dodge City and have lived there for six years. My place is a little over half a mile from the Arkansas river. My business is raising alfalfa and handling cattle. I have about one hundred and sixty acres of land seeded and I run about two to four hundred head of cattle. The average crop of alfalfa
1401 for the season is from a ton to a ton and a half per acre. I make three cuttings. For the first two or three years after I went there the average yield was from three to four tons to the acre. The yield of my alfalfa has fallen off fully one-half since I have been there. I raise alfalfa for seed when I can. I attribute the falling off in the productiveness of my alfalfa to the lowering of the water in the river. It is the only cause I can give for it. The water has materially lowered in the river since I have lived on the banks. The water has been pretty high this year of 1904. The other years that I referred to were down to 1904.

I suppose the average price of alfalfa in the fields or in the
1402 stack would be about four dollars per ton. It has been higher during the last two or three years than it was before. We raise alfalfa on the bottom lands. I have first and second bottom land, or lower and higher bottom land. There is six or eight feet difference between my first bottom and second bottom lands.

When I went there my best alfalfa land was closest to the
1403 bluffs. On the highest ground that I have was the best alfalfa; now my best alfalfa land is on the lower bottom. The lowering of the water in the river has brought this change about.

Cross-examination.

By Mr. DAWSON:

When I came to this place six years ago there were about one hundred acres of alfalfa on it. I have about sixty acres—some on
1404 the lower and some on the higher ground—first and second bottom. I don't know how deep I would have to go to find
1405 water on my first bottom. On the second bottom it is sixteen feet before you touch water. On the second bottom I went sixteen feet to water last summer. I put down a well right at the foot of the bluffs. That is just as high as my alfalfa land. I have some alfalfa east and some west of that, so that it is just about as high as any of the alfalfa is. I don't know whether the water under the surface there or at any other place on my land is any lower than at any other time before. I don't know anything about it. I don't raise any natural hay, only a little I cut on the island. I raise nothing but alfalfa on my first bottom.

I know there has been a falling off in the river in the last six years. It flowed more water the first three or four years that I was there than during the last three or four. I can't describe the volume. There was always water in the river. That was the principal thing I took notice of, was that there was enough water to
1406 water my stock. That was all I cared for. It is not all I care for now. I would like to have the water deeper. During the first three or four years I was there the water in the river during ordinary stages would go down sometimes until it wouldn't be in the main channel more than two or three rods wide and perhaps four or five inches deep, but it never went dry. It went dry last fall. That was the first year that the river has been entirely dry since I have been there. I think there has been as much water there this year as any year since I have lived there. There have been
1407 more floods this year than common.

We cut the alfalfa about three times a year, and then I pasture the land in the fall. I don't know that cutting it in that way and then pasturing it has a tendency to make it produce a poorer crop. We all do that, and don't consider that it hurts it.
When I put in a new stand of alfalfa I don't pasture it the
1408 first year. It takes it there now about three or four years before it gets to be good alfalfa. It has not been my experience that after it once gets a good start, the first three or four years following that are the best years in the life of the alfalfa. I may be mistaken, but don't think I am on that. I presume that my alfalfa this year will make two to two and a half tons to the acre. Lately we have had pretty good rains this summer, but prior to that we didn't have.

I run four wind mills on my place. I have two on the bottom and two up in the pasture—in the hills. There is one of these that we don't keep pumping hardly any of the time; it is used for
1409 watering stock in the winter, and another one I presume we run it six hours out of the twenty-four. We run it slowly,

tied down, and irrigate a little garden patch, I think about one-sixteenth of an acre. I pump water to irrigate. In the pastures I run the pumps enough to water cattle. It depends upon how many cattle I have there and how much rain lodges in the pond. The other two of the four are right near the house. The others
1410 are—one is about two miles and the other about three miles from the river. Practically all the farmers up and down the river so far as I have seen have windmills running. They don't irrigate very much in garden patches. There is occasionally a man who will water a little patch as I am doing. We don't irrigate but very little.

Redirect examination.

By Mr. ASHBAUGH:

1411 This land had been in alfalfa for six or eight years before I bought it. If the alfalfa lands were sufficiently saturated the pasturing of the cattle as I pastured it would not do the alfalfa any injury. (Objection.)

1412 GEORGE W. REIGHARD, Dodge City, Kansas.

Direct examination.

By Mr. LOOMIS:

I have lived in Dodge City since 1878. I first knew the Arkansas valley in March, 1869. I was then engaged in freighting from Fort Hayes 100 miles north of here, to Camp Supply, in what is Woodward county, Oklahoma, now, which was then the Indian Territory. We crossed the river about every twenty days. I quit freight-
1413 ing in 1878 and have lived in Dodge City ever since. During the first years I was here after 1869 there was considerably more water than there is now, all during the year, and in the same seasons, about the last of May or first of June, we would have what we called the June rise, and that would last until about the first of September. We always counted on high water in the summer. The June rise would come as soon as the snow melted in the mountains in the spring, and sometimes it would come a little earlier. During
1414 the late years I don't think we get any water from the melting of the snows in the mountains. This changed condition began about twelve or fifteen years ago, I think. Along there. During the early years, in the winter, along until it would get to the rise, the bed of the river was generally covered with water pretty well over, from bank to bank, and would be from two to three feet deep along there. Hardly that then. About two feet deep, say. It would come up to the hubs of the wagon. From the time the June rise subsided until the fall months there were a good many times when it was pretty difficult to ford. It would come into the bed of

the wagon. It would be about the same as during the winter. It would stand from bank to bank and generally came up to the hubs of the wagon. Sometimes the channel would be a little
1415 deeper, and at other places shallower. After 1874 we didn't cross the river as much as before. We crossed on bridges then and didn't notice it so much after that, but we crossed cattle a good bit, and then about twelve or fifteen years ago, I think, the river began to go dry. Along in September and October, after the rise, the river would be tolerably low. That would be the lowest time, about. Then when the weather got cooler more water came. This continued up to the time they began to take the water out of the river in ditches. During the last twelve years or thereabouts there has been a good part of the time it has been dry, hardly any flow in the river during the summer and fall months. This condition
1416 that I refer to has been from about 1890. Since that time most of the summer there has been no flow. All that I have noticed of the underflow has been nothing more than digging a well for stock water. I dug a well on my farm about a mile and a half east of Dodge City. I moved there in 1890. I dug a couple of wells there then. I went just ten feet to water from the surface on the second bottom. The water has dropped now and it is about 12 to 13 feet to water, I guess. We have a large pump there, an 8-inch pump, that we used for irrigation for a while, and I know by that pump what the flow of the water was. We measured it. I have noticed that the water in the holes or sloughs in the bottom
1417 lands along the river valley rose and fell with the rise and fall of the water in the river. (Objection.) When the river rises the water rises back in the bottoms in holes. There is a slough runs through my place about a quarter of a mile from the river, and I have a hole scraped out in that. Our stock water there when the river is up and there is plenty of water there. In the winter there is some water there now by scraping down to the underflow. When there is a rise in the river there is plenty of water in that hole; when the river lowers the water will run out. There will probably be three or four feet of water. When the river goes down it will go plumb dry sometimes. When I first went down there it was kind of springy along that slough. We used to water cattle in there.

1418 I have had experience in raising alfalfa for about thirteen or fourteen years. I have some on the first and some on the second bottoms. Probably we would get about three and a half tons to the acre during the year as an average crop, and have
1419 about four cuttings. About 1890 to 1893 we used to get six tons to the acre. About three or four years longer, after I got my alfalfa started good, it was very heavy. It gradually fell off, and now produces probably three and a half tons to the acre. On the north side of my alfalfa land it is about ten or twelve feet to the underflow, and on the south side about four feet. It is further now to the underflow than it was in 1890 when I put in the alfalfa with

the underflow two feet from the surface of the ground. (Objection.) I attribute the falling off in my crop of alfalfa—one thing, I think that the underflow is lower, and maybe pasturing it some, the
1420 ground getting settled down solider than it was. The lowering of the underflow has affected it some, I think, and it is deeper now to water. The successful production of alfalfa requires a good deal of water, and when the underflow falls in my judgment it affects the growth of alfalfa.

Cross-examination.

By Mr. HAYT:

We get the best growth of alfalfa on the north side here. The distance to the water level or the ground water or the underflow on the north side in the alfalfa fields is about four to five feet,
1421 and then farther back it runs about twelve feet, on the north side. On the south side it is about three or four feet to water. I haven't land on both sides of the river. The alfalfa grows on the land that is nearest to the river best. In my judgment from two to four or six feet is the best water level below the ground for a good crop of alfalfa. If it is lower, below six feet, the crop will be lessened thereby. I think my land is about the best in the county for the growing of alfalfa. When I get from five to six tons an acre it is about the highest yield in the county. I have never examined alfalfa to ascertain how far the roots would go for water, but I have found the roots down about six feet, down
1422 about the sand. If the water was too close to the surface it would destroy the alfalfa by rotting the roots, I believe, but I don't believe two feet would hurt it, at least it has not hurt mine. I attribute this falling off in crops some to the lowering of water and some to the pasturing. We pasture during the winter months. We cut our crops, and about the first of October we generally pasture it. We used to allow a large number of cattle to pasture on it all winter. We don't pasture it quite so heavily now as we used to. That is very hurtful for alfalfa if we pasture it too short. It wouldn't hurt it if we didn't pasture it too short. If we pasture several hundred head of cattle after cutting four crops, that is pasturing it pretty short if we leave them on too long; that is, all winter.
1423 They ate whatever they could get of the growing crops, but we fed them alfalfa too. I think the tramping down of the ground by the cattle will let the water run off considerably instead of going into the ground very much. The water runs off better when the ground is pulverized or looser.

I said it was about twelve or fifteen years since the river began to go dry—since about 1890. For a few years before that I didn't notice the falling off in the river so much. We were running cattle in there. Since 1890 I have been living right along the banks of the river, you might say. I think the river was pretty dry

for a year or so before 1890. I have been acquainted
1424 with the river since 1869, and I never saw it dry in those early years. I was in the habit of crossing the river about every twenty days for a number of years, summer and winter. In 1874 they built the bridge across here at Dodge City, and we didn't cross the river that year and didn't notice it so much. I guess it is a fact that in the year 1874 the river was practically dry along here at Dodge City and for nearly a hundred miles above for several months during the season, but we watered our mules in the river in 1874. I don't think there was any other year that I saw it dry prior to 1876, and I don't recollect any prior to 1890. There has been some water running this season in the river, about all the season. We had a good big flow from some time in June up to the present time, and there is quite a good body of water in
1425 the river to-day. There was much more two weeks ago than there is to-day. We had a rise in the last ten days.

In the early days when we were freighting we crossed the river here at Dodge. We didn't go from here farther up the river into Colorado. I have been in Colorado. We used to go up from about 1880 to 1885 to the Colorado line and get our cattle and bring them down the river. I have been up in Denver and Pueblo in 1878. I don't believe I remember any irrigating along the line of the river above in Colorado at that time. They were irrigating over there at the Platte at that time, about Greeley. The first time I saw them irrigating on the Arkansas river with river water was along about 1886 or 1887. In 1879 I went to Pueblo and from there to Denver. I don't remember any irrigation on the Arkansas river at that time in the vicinity of Pueblo and below there, though there may have been.

1426 The wells that I dug in 1890 were about half a mile back from the river. There was no depression or anything at that point. In the old slough I dug some water holes. The first time I moved down there there was water running in the slough there in the fall and winter. This slough starts about half a mile west of me and runs down toward the river and runs into the river. It is about a mile long and a quarter of a mile back from the river. When the river gets high the water overflows and runs out over this slough. I think that was an old channel of the river at some time. There were springs in there and we dug them deeper,
1427 and it was in these holes that we found that the water lowered and raised at times. The pump that I used for irrigation was about half a mile from the river, on the north side of my farm. We went just ten feet in depth at first when we dug the well. We used an eight inch pump, which we called an Infidel. It threw about four gallons at a stroke when it was running right and made about twenty-five to thirty strokes to the minute. We used to irrigate about half an acre with that pump, for a garden. We didn't use the water for any other purpose. We had another well for do-

mestic and stock purposes. After we had pumped for some
1428 time the water ran down and kept sinking and my pump was too short. We had to get a new pump. We lowered it and put the spout higher up and put the pump down in the water lower.

Redirect examination.

By Mr. LOOMIS:

The water that came out in that slough came out of the ground—out of the quicksand. It came from the underflow. (Objection.) Of course when the river rises the water runs through that slough, but there has water run in there when the river was not up.
1429 It is spring water. When we would have high water it would run over above and come down through the slough, and this would occur once a year maybe.

I have probably five or six acres on first bottom in alfalfa, and have probably a hundred acres on second bottom. On the north side it is about eleven or twelve feet from the surface of the ground to the underflow and at other places it is about four feet, on the second bottom. There isn't very much difference in the depth to the underflow between the first and second bottoms; the first bottoms are almost level there and there is a gradual rise from the first to the second bottom.
1430 The river is dry now pretty often in the summer time. Taking it as it is now, there is not as much water as in the earlier days at the same season. This is the 27th day of August, 1904. We use our pump for irrigation purposes during the summer season. We use it more in the spring in April, May and June.

I spoke about not pasturing my alfalfa land as much in the late years as formerly. I made this change about three years ago. My alfalfa crop has fallen off during the last three years. It is not so good. Prior to that time I was in the habit of pasturing my alfalfa land for probably four or five or six years. I think the fall
1431 of the underflow has a good bit to do with the falling off in alfalfa. (Objection.) I think that the falling off is the cause of most of it. Of course the pasturing may have had something to do with it. I haven't pastured it for the past three years, but the crop has fallen off notwithstanding that fact.

Recross-examination.

By Mr. CAMPBELL:

1432 In respect to the extent of pasturing alfalfa, about two years back and then probably for two or three years we pastured it pretty heavily during the winter, about from the first of October to the first of March. I think it kills it out if you pasture it too heavily.

Redirect examination.

By Mr. LOOMIS:

I am chairman of the board of county commissioners and have been a county commissioner for three years. I have probably pas-
tured two or three hundred head of cattle on about one hun-
1433 dred and sixty acres, and then we would feed them on alfalfa
awhile. We didn't think at that time it would hurt it. We found out it would be better not to pasture it too much. I attribute the falling off of the crop prior to three years ago about all to the fact of the lowering of the underflow. (Objection.)

PUEBLO, COLORADO, August 30–31, 1904.

1436 Mr. Ashbaugh, on behalf of the complainant, introduced in evidence Complainant's Exhibit A–6½. (Objection.)

Mr. Ashbaugh, on behalf of the complainant, also offered in evidence Complainant's Exhibit A–13.

1437 E. R. CHEW, Pueblo, Colorado.

Direct examination.

By Mr. LOOMIS:

I have lived at Pueblo, Colorado, for nearly twenty-five years. I am fifty-two years old, and am irrigation division engineer of irri-
gation division No 2. This is a State office in the State of Colorado,
created by statute, and I hold my commission by appoint-
1538 ment from the governor and draw my salary from the State
of Colorado. I have been irrigation division engineer for nearly eight years. Prior to that time I had no connection with the irrigation department of the State, but was a mining man and in the real estate business, all over the western country, with headquarters here in Puelo. I am about as thoroughly acquainted with the Arkansas river, its tributaries, its valley and the water shed as a man could be. As division engineer I have entire jurisdiction over this
division. Division No. 2 covers the Arkansas river and all
1439 its tributaries in the State of Colorado. Colorado is divided
into five divisions, and division No. 2 is divided into eleven districts. As division engineer of division No. 2 I take charge of the river and all its tributaries, regulating the amount of water that goes into each canal and also into the reservoirs. No portion of the Arkansas river or any of its tributaries is in any of the other divisions. My duties are regulated by statute. Sometimes there are regulations through the State engineer's office, something that doesn't conflict with the statute. We make arrangements between us. There are no other directions given me by any authoritative source. I have entire jurisdiction of these matters, unless it comes

to a trial before a court, a case of injunction or something of that kind.

1440 I get at the amount of water that each company, person or corporation has a right to or that it uses by its decree and by the amount of water in the river at the time or in a stream that is a tributary to the river, wherever its ditch or its canal may be located. I mean by a decree the amount of water that is allowed by court through its referee to a ditch claiming the priority. The water is first appropriated by use upon the land and then the appropriation is secured through the district courts in this State. The appropriator must finally get a decree in the courts. These decrees are first filed of record in the district clerk's office and then he certifies a copy up to me as division engineer and I keep those certified copies in my office.

1441 In my official capacity I become acquainted with the different companies or persons or corporations that appropriate water from the Arkansas river and its tributaries in certain cases or to a certain extent. I never care who owns the canal; it makes no difference to me. I never try to find out who owns it. All I want is the priority of the canal and its decreed amount of water,

1442 location, etc. Each of these canals is designated by name and by number. The Fontaine Qui Bouille is a tributary of the Arkansas here at Pueblo. These tributaries are all numbered and many decrees are numbered. The number often indicates the priority on a particular stream and not the priority in the whole division.

I don't know of any appropriation of water out of the Arkansas river or any of its tributaries made by the State of Colorado. I do know of a proposed appropriation of water at or near Canyon City. (Objection.) So far as the State is concerned, I suppose that is a dead issue. It is not before the State now. When the enterprise was first undertaken it was for the State to appropriate so much water and build a canal on the north side of the river

1443 to irrigate certain lands north and west of Canyon City. I don't remember the exact time, but it was a number of years ago, when they first started the ditch, but it was some time in the '80's. The head of the canal was near the head of the Grand cañon of the Arkansas, probably a couple of miles west of Canyon City, as near as I can remember. They built several miles of canal up there, something like three or four miles, but I am not positive as to the number. It would not cost much to put the amount they did build in good condition. I understand the legislature of Colorado

1444 turned it down as a State proposition. The legislature refused to vote the necessary bonds or the convict labor to build it. The legislature of Colorado had provided that this part should be built through the convict labor at the State penitentiary at Canyon City, and the convict labor was used for that purpose. That is my understanding. The canal was not completed at all, in fact hardly started. It was not built enough to run water in it. If

any water was turned in it was not intentional. The ditch couldn't carry it. I don't know the dimensions of that canal, but I presume it was a canal that would carry three or four or five hundred feet of water if properly constructed. I have never been on this canal; I just saw it going over the railroad.

1445 A cubic foot of water, as we measure it in this State, is a cubic foot per second of time. This canal in its windings would probably run fifty miles from Canyon City to the Fountain. I don't think it was ever intended to cross the Fountain. There is a large area of land under that canal; whether it is intended to cover all of that I don't know. It would cover forty or fifty thousand acres of land. I don't know whether I have in my office any maps or profiles showing the proposed site of that canal. I never looked. They should be in the State engineer's office at Denver, if there are any. The State had the work done, but who was in

1446 charge of it I don't know, other than the State. I presume it was done under the governor first, primarily, and of course the State engineer would have it under his charge. I can't state when the act of the legislature was passed to build this canal. A portion of the territory covered by this canal is covered by small ditches from Beaver creek to Oil creek. There is no other large canal that now takes the place of the proposed one referred to, and that lies open for future development if

1447 they see fit. As to the cost of that, to have it completed as proposed, I don't presume it would cost the State anything except the labor from the penitentiary. I don't know of any money that would be paid out excepting for shooting material and other supplies to build with. (Objection.) I can't give anything like a fair estimate as to what it would cost to complete the canal as proposed. (Objection.) It would cost but very little, I presume, to put the portion of the canal that was dug in repair and to build it so that it could be used for irrigation purposes. It was rough work. It would cost so much a yard. It is worth twenty or thirty cents a yard for removing the dirt. I presume it could be put in order for three or four thousand dollars for the first three miles. I

1448 don't think there is any land under it at that length that would be susceptible of water from it. I think it would have to go two or three miles yet to get to land that could be irrigated by water that could be taken from it.

I am acquainted with the Bessemer ditch. It is a canal that takes out water about thirteen miles above Pueblo, on the south side of the river. The Bessemer Ditch Company is a corporation organized for the purpose of taking water out of the Arkansas river. (Ob-

1449 jection.) The head-gate of the Bessemer ditch is located on section 33, 22–66. The canal is about 40 miles long, I guess, and is about 20 feet across the top, and is built in a "V"

1450 shape. The decreed appropriation of the Bessemer ditch is 364 cubic feet as shown by the records, (objection,) of the

1451 date of May 1st, 1887. The date of the decreed appropriation is regardless of the date when the decree was entered of record, the decree relating back to the date of the appropriation. The Bessemer ditch would irrigate about fifteen to twenty thousand acres, and extends back at the farthest point eight or ten miles from the Arkansas river, and it would average four or five miles back from the river, approximately. It irrigates land only
1452 on the north side of the ditch. The land slopes somewhat toward the river. I don't know what the grade of that ditch is.

The fall of the Arkansas river through the State of Colorado would be from twenty-five to two hundred and fifty feet per mile, taking it from Kansas to its source. I never had any occasion to measure it or to test it. The grade of the Bessemer ditch is a good
1453 grade, something like a foot to the mile, but I don't know exactly what it is. The Bessemer ditch is the farthest big ditch up the river toward Canyon City.

The next large ditch coming down the river, below Pueblo, is the Colorado canal, commonly known as the Bob Creek canal.
1454 Its head-gate is located on section 10, 21–62. It runs in an easterly direction on the north side of the river and is about 50 miles long and about 43 or 44 feet wide on the bottom, I think. It is controlled by the Twin Lakes Land and Reservoir Company, and its mean depth is about three feet. It has a decreed appropriation of 756.28 cubic feet, of the date of June 9, 1890. This
1455 canal extends down into a reservoir located at the eastern end of it. The reservoir has no decree, it simply has a filing in the State engineer's office, I presume. The water runs down this canal into the reservoir. That reservoir is about two miles long by about three quarters of a mile wide, and is used for furnish-
1456 ing water for beet lands near Sugar City, and is about two miles from the town site. There are probably thirty thousand acres of land under the Bob Creek canal and this reservoir. I mean the land that is actually under the ditch, not the land that could be actually cultivated by water from the ditch. I didn't mean the land that is actually irrigated from the ditch when I gave you these estimates. I gave you the amount of lands that are under the ditch. There is lots of land under the ditch that could not be cultivated. A ditch is the main carrying canal, and a lateral is
1457 taken from the ditch to the cultivated lands, like the branch of a tree. The reservoir appropriation is entirely different from the appropriation of the canal.

1458 The Bob Creek canal at its farthest point would reach back probably fourteen miles from the Arkansas river. The land that is irrigated from it lies on the south side of the
1459 canal and between it and the river. The average distance of this canal from the Arkansas river I think is about five or six miles.

1460 The next canal coming down the river is the Rocky Ford Highline canal. Its head-gate is located on the south side of the river in section 17, 21–61, twenty-four miles east of Pueblo. It runs in a southeasterly direction and is about 75 miles long, and is at its farthest point *is* about twenty miles back from the river, has a fall of about one and a half feet to the mile, I should think, has a decreed capacity of 418 cubic feet, dated January 6, 1890, and its carrying capacity would be 550 to 600 feet at the time of the decree. This canal absorbed prior appropriations as follows:

	Cubic feet.
1461 "Enterprise," 1867	2.5
"Ballow Hill," July 1, 1869	16
"Ballow Hill," July 1, 1885	30
"Allen," March 11, 1886	2
"Allen," 1890	2.5

These appropriations last named are added to the appropriation of 418 cubic feet of June 6, 1890, provided there is water for
1462 that date. By absorption I mean when a canal purchases the water of another canal it is changed by statute through the district court in the State engineer's office and then the ditch selling the water is abandoned and the water is carried entirely through the ditch that purchases it. It is a mere matter of purchase.

1463 We have about twenty-five thousand acres irrigated from the Highline canal on the north side of it. The canal is on the high lands. The canal perhaps reaches a point at its greatest altitude of 75 or 100 feet above the river at a corresponding point, maybe more. I don't know.

1465 The next canal we find in coming down the river is the Oxford Farmers' canal. It is on the south side of the Arkansas river, its head-gate being on section 31, 21–60. It is
1466 about fifteen miles long, is fifteen feet wide across the top, and varies in depth from two to four feet, extending back from the river at its farthest point probably six or seven miles, with a grade of one and a half feet to the mile. It has a decreed
1467 appropriation of 116 cubic feet, dated February 26, 1887. The Oxford Farmers' canal absorbed an appropriation of 14 cubic feet made by the Enterprise ditch in the fall of 1867. There are between five and six thousand acres, I presume, under this canal.

1468 The next canal coming down the river is the Otero canal. Its head-gate is located on section 17, 22–59. It is about
1469 forty miles long, about ten feet wide on top, four feet deep, reaches back at the farthest point about five miles from the river, and has a decreed appropriation of 123 cubic feet dated
1470 March 3, 1890. I should — there are between eight and ten thousand acres of land irrigated from it.

The next canal coming down the river is the Catlin canal.

1471 The head-gate is on section 7, 22–59. It is about 35 miles long, 25 feet wide, and about five feet deep, with a grade of one and a half, and has a decreed appropriation of 248 cubic feet, dated December 3, 1884, (objection), and a further appropria-
1472 tion of 97 feet, dated November 14, 1887. There are about twenty thousand acres of land under this canal, and about
1473 ninety per cent. of it can be irrigated. The greater portion of this canal is about four and a half to five miles from the river.

The next canal coming down the river is the Laguna or Lake canal. It is located on the north side of the river, its head-
1474 gate being on section 24, 22–58, about fifty miles below Pueblo. It is about twenty-five miles long, about twenty-five feet wide on top, and about six feet deep, and has a decreed appropriation of 155 cubic feet, dated September 25, 1889. There is one reservoir into which this canal drains. The reservoir
1475 has no decree; it has simply been filed. There are about eighteen thousand acres, I think, under the Laguna canal, and about ten or twelve thousand acres can be irrigated from it.

1476 The next canal coming down the river is the Rocky Ford ditch. It is on the south side of the river and its head-gate is located on section 30, 22–57. It is about fifteen miles long, about fifteen feet wide at the top, and twelve to fourteen feet wide at the bottom, and about four feet deep, and has a decreed appropriation of 111.76 cubic feet, dated May 15, 1874. I presume there are about seven or eight thousand acres of land under this canal, and about ninety-five per cent. of it can be irrigated from it.

1477 The next canal coming down the river is known as the Fort Lyon canal, and is operated by the Arkansas River Land, Reservoir and Canal Company. It is on the north side of the river, and its head-gate is located on section 32, 23–55. It is 110 miles long, 60 feet wide, and the depth varies from four to six feet, and at the farthest point is probably fifteen miles back from the river, and its greatest altitude above the river would not be perhaps over thirty feet. It has a decre-d appropriation of 164.64 cubic feet, dated April 15, 1884, and a further appropriation of 597.16 cubic feet, dated March 1st, 1887. I presume there are about forty
1478 thousand acres of land under this ditch, and seventy-five per cent. of it can be irrigated. I think the Fort Lyon canal
1479 was never built its surveyed length. I think it is flumed across Horse creek and goes as far east as the Big Sandy. The average location of the Fort Lyon canal would be twelve or fifteen miles back from the Arkansas river. I don't know exactly how far it is.

Coming down the Arkansas river, the next canal of any consequence is the Amity. It is on the north side of the river. Its head-gate is located on section 36, 22–48, about eight miles
1480 above Lamar. It is about fifty miles long, twenty feet wide at the top, and six feet deep. At the farthest point it reaches

about ten or twelve miles back from the river, with an altitude above the river of probably fifteen or twenty feet. It has a decreed appropriatien of 283.5 cubic feet, dated February 21, 1887. There are about sixteen or eighteen thousand acres under this canal, and about eighty-five per cent. of it can be irrigated.

The next canal coming down the river is the Lamar canal. It is on the south side of the river. Its head-gate is located on
1481 section 29, 22–46, two or three miles below Lamar. It is about thirty miles long, about fifteen feet wide, and about three to three and a half feet deep. It has decreed appropriations as follows (objection):

15.75 cubic feet, dated November 30, 1875;
72.09 cubic feet, dated November 4, 1886;
13.64 cubic feet, dated April 16, 1887;
11.7 cubic feet, dated September 11, 1889;
184.27 cubic feet, dated July 6, 1890.

At its farthest point this canal is six or seven miles back from the river, with an altitude above the river of ten or fifteen feet. There are about fifteen thousand acres of land under this ditch, and over ninety per cent. of it can be irrigated from it.

1482 The next ditch coming down the river is the Graham ditch, about eight or ten miles below Lamar. It is on the south side of the river. Its head-gate is located on section 25, 22–45. It is about seven miles long, is between six and eight feet wide, and is from two to three feet deep, and has a decreed appropriation of sixty-one feet, dated August 24, 1891. (Objection.) It is two or three miles back from the river, and there are three or four thousand acres of land under this ditch, and perhaps ninety to ninety-five per cent. of it can be irrigated.

1483 Coming down the river the next canal is the Buffalo Creek ditch. It is on the north side of the river. The head-gate is about eighteen miles below Lamar and twelve miles from the Kansas-Colorado State line, and is located on section 31, 22–43. This canal is about eight miles long, is about eight or ten feet wide, and two or three feet deep. It has a decreed appropriation of 67.5 cubic
1484 feet, dated January 29, 1885. (Objection.) It goes back not over four miles from the river, and there are probably four thousand acres of land under the ditch and probably eighty per cent. of it can be irrigated.

1485 All of these canals that I have described derive their water from the Arkansas river and its tributaries. The total amount of water decreed to the ditches that I have been questioned about amounts to 3997.31 cubic feet per second of time. The total amount of land that could be irrigated from these several ditches amounts to 318,504 acres. This is not the land that is irri-
1486 gated. The amount that is actually irrigated by these several ditches referred to was 200,520 acres. These figures are taken from the reports of the district water commissioners of a year

ago. I think that the number of acres has not increased since that time, nor materially decreased.

There are other appropriations that have not been specifically mentioned by me. I have an official record of the amount of all the decreed appropriations of the Arkansas river and its tributaries and the total amount is 10,248.56 cubic feet per second of time.

1487 There are appropriations of water from the Arkansas river and its tributaries in several ditches that have been filed upon that have no decrees—very small ones. They get water when they can get flood water, that is, surplus water. We don't recognize those ditches only as "outlaws" until there is a surplus of water or until all decrees are supplied.

I have an official record of the amount of water filed upon for reservoir purposes, the total amount being 1,139,490,773 cubic feet. The difference between the total amount of the several ditches that I have specifically mentioned, and the total amount of 10,248 cubic feet, is the amount that has been appropriated by other

1488 ditches that I have not described. These other ditches are small ditches and they run from one-tenth of a cubic foot per second to probably one hundred cubic feet per second. Very few of them would have an appropriation as large as a hundred cubic feet per second. Perhaps eighty per cent. of them would be under ten cubic feet per second. Most of them are local, individual, personal appropriations made by farmers. There are very few of them upon the river proper; most of them are from the tributaries in those various counties through which the tributaries run. There are but few ditches on the main river. These other water appropriations are as a general thing owned and used by the own-

1489 ers of the land irrigated. The appropriations spoken of by me as amounting to 3,997.31 cubic feet per second are used by the owners of the water rights. You take a canal that is owned by a stock company and they sell land with water and the man who buys that land buys so much water and he appropriates that to his land. The company don't use it, but he uses it, and that is the way the water is used from all these corporate ditches. There are other kinds of ditches than corporate ditches, that is, individual

1491 ditches. To what extent the ditch companies that I have referred to sell water to any persons desiring to purchase the same I do not know personally; that is a question that I can only answer by hearsay. My duties end at the head-gate, and as I said yesterday, I never inquire what a ditch is doing or what a company is doing with the water, unless they waste it. (Objection.) Whether a person could get water on land that he has not bought from one of these ditch companies depends entirely on his location. If he couldn't buy it from the company he might not be able to

1492 get it at all. If they had water to sell he might buy it from the company. (Objection.) I presume some of those ditch

companies are in business for that purpose, but I don't know how they conduct that business. (Objection.)

In the State of Colorado below the Grand Cañon there are between twenty-five and thirty tributaries of the Arkansas river. Some of these are Grape creek, Hardscrabble creek, Four-mile or Oil creek, Beaver Rock creek, Fountain, St. Charles, Huerfano, the Apishipa, Tempe, Horse creek, the Purgatoire and the Big Sandy. These are nearly all wet streams, and by the term "wet stream" we mean one that furnishes a continuous flow of some amount to the river.

1493 The records of the flow of the Arkansas river in the State of Colorado are to be found in the State engineer's office. Some records are kept here at Pueblo by a gauge in the river. There is an ordinary gauge here, and the gauge is read every morning. It shows the height of the river. When we see the gauge we make computations showing how many feet of water there are in the river. There are measurements made of the flow of the river at Granite, Salida, Cañon City, Pueblo, at the Highline dam, at the Oxford Farmers' dam, at the Rocky Ford bridge, at the Fort Lyon

1494 dam and at the Colorado-Kansas dam. These records are made by parties appointed by the State engineer and they make separate reports to him at his office. It is only in the last eight years that there has been any general report made at all or any very accurate report kept, but they have information of

1495 some kind as to the flow of the river. We report the flood waters, and the amount, of the tributaries. This is all that we make a note of, and that has not been the general practice until the last few years.

My official duties are to regulate the flow of water into each canal according to the amount in the river and their decreed priorities. If there is water enough in the river to supply each decreed priority it gets the full amount if it wants it. If it is not enough to supply each of the decreed priorities then I give it to them according to their decrees; that is, according to the age of the ditch. If there is not enough in the river to supply more than one of these ditches that I have referred to, then I give it to that one. If there was not enough in the river to give it its full decreed priorities, then it would get what was in the river. It would take it all. If these ditches that have been specially referred to should want the water of their decreed appropriations and there should not be that amount in the river, then they would take the whole flow of the river,

1496 if they were entitled to it. There might be older ditches on the river than these referred to that would take amounts that would decrease that very much, but the result of our distribution would be to take the whole flow of the river. We can't do it because there is a large amount of seepage that comes in below here, that runs into Kansas, that we can't get hold of. We would get hold of it if we could.

The dams at the head-gates of the different ditches referred to are sometimes built of brush, dirt, rocks and weeds scraped together to

make a temporary dam and sand mixed in it to hold the water. Sometimes by piling sheets driven down with the piles, sometimes by masonry and sometimes by concrete or cement work. The only dam that is wholly or in part built of cement is the Amity. It was constructed by sinking to a certain depth down into the sand. I don't think they ever went to bed rock but one place. And then poring in cement. It was not a solid dam across the river, of concrete. There were sections that were piling, I think. I don't think the whole width of it was concrete. There were only sec-
1497 tions of it, and heavy pillars. The dam is across the bed of the river. There is a sluice gate in the canal. The sluice gate was not constructed around the dam or at either end of it. The dams are built so that the water can run over them. There wouldn't be any need of a sluice gate if the dam was properly constructed. The surplus water would all pass over it without difficulty. They are high enough to hold the floods. Whether the Amity dam was constructed so that at the ordinary flow of the river any of the water of the river passed around, over or through the dam is a difficult question to answer. There is no ordinary flow in this river. During the dry season of the year there wouldn't be any water down there at all. If there was any water flowing in the river there wouldn't any of that water pass over, through or around the Amity dam if the Amity could take it. The head-gate of the Amity canal is located very close to the dam, and just below
1498 it. The ditch connects with the water that is dammed up by the construction of the dam. When the whole amount of the flow of the river at low water at that place is not more than the Amity canal can carry then there is none of it will go by unless we order it for ditches below; but if there is only what the Amity canal priority calls for it will never get by. The dam is so constructed that the amount of water flowing down to the dam could all flow into the ditch if there wasn't any more than the ditch could carry.

The sluice gate is built near the ditch and is about eight
1499 hundred or a thousand feet below the dam. Its purpose is to turn out the surplus water and keep the ditch clean. The Fort Lyon ditch has a pile dam extending entirely across the river. It is so constructed that water can go over it. When there is only such an amount of water in the river as the canal would carry we do not allow the whole of it to go into the canal unless it is entitled to it. If the canal was entitled to it then it would take it, but that is not the case, because there are water priorities below it. The Fort Lyon canal is so constructed that it can take the total
1500 flow of the river provided there is not too much water in the river. There are times when the Fort Lyon canal could take the whole of it when the river is low. At the ordinary season when there is not any particularly high water this Fort Lyon canal would take all the flow at that place about one-fourth of the year, provided it was entitled to it. When there is simply an ordinary flow of

water in the river the Amity canal can take the whole flow of the river that would reach her point for probably a quarter of the year, provided she was entitled to it. That portion of the year would probably be the winter months. Sometimes in the summer you would have to mix it up a little. The dry portion of the year is
1501 sometimes in the spring and sometimes in the fall and sometimes in the winter, and there is no average. It occurs very frequently that when there is no excess water the Fort Lyon and the Amity ditches could take the whole flow of the river through the months of August, September and October, provided they were entitled to it. After other priorities are satisfied these two canals could take all the flow of the river under the conditions stated during the months of August, September and October. The total amount of water that flows in the river would not be indicated at all by the amount of water that these two ditches carry under such conditions.

All the other ditches that I have mentioned have pile dams. The dam at the Highline head-gate is a smaller one, not quite so high, but the Bob Creek dam is built about eighteen inches or two feet
1502 high above the bed of the creek. They are all clear across the river. There are no sluice gates built anywhere in the dams, but the *surface* water goes over the dam. The water at a low stage passes over the dams, and the dams are not built high enough to
1503 prevent low water from passing over them. The object of these dams is to raise the bed of the river so as to throw the water into the ditch. During the dry season when the flow of the river is low these dams throw the whole flow of the river into the ditch, if the ditch is entitled to have it. It can carry the amount of water that is in the river. In certain places during the dry season of the year when there is no flood or freshet, when these particular ditches have a right to the water, there is some water goes down the river immediately below the dam. This is where the seepage rises very strong and sometimes there is a better flow below the dam than above it. This seepage is return water to the river from the high waters and even from low water. The river bottoms when there is water in it are filled full of water, and when the water decreases that water gradually goes back to the river or to where it can make its escape again on the surface. That forms a seepage. I presume the bottom or channel of the Arkansas river through the eastern portion of the State is composed of rock. The sand rests on the bed
1504 of the river, on the rock, and this gravel is all full of water. I should think this sand is twenty feet deep in some places, but I couldn't tell you anything about it definitely. (Objection.) I don't believe there is a dam in the river but somewhere within a few hundred feet of the dam there is quite a little return of seepage to the river. The dam was not constructed so as to prevent that. The dams are constructed for the purpose of stopping a sufficient amount of water to supply the decree of that particular ditch, and they are so constructed as to take the whole of the river

provided the ditch is entitled to that amount of flow. It is
1505 true that during the dry seasons there is a dry portion of the river bed below the dams—dry on the surface, a foot or so maybe. The majority of the ditches between Cañon City and the Kansas State line have got some kind of a construction even if they simply take a scraper and scrape up the sand and make what they call a sand dam. These sand dams are constructed for the same purpose as the others—to throw the water into the ditches. These sand dams are probably constructed ten or fifteen times a year. It is just simply like taking a plow and running a furrow across
1506 the river.

Besides the dams at the Amity and Fort Lyon head-gates there is the dam at the Colorado-and-Kansas, the Oxford Farmers', the Highline, the Bob Creek, the Bessemer, and there is one at Cañon City. The Arkansas river and its tributaries get their supply of water from two sources—the rainfall and the snow in the mountains. By the mountains I mean the Rocky mountains—the Green Horn, the Mosquito and the main range—the main divide.

The deepest place that I have seen the rock under the bed of the river was where it was twenty-two feet deep.

1507 There are wells along the Arkansas river through this part of Colorado. They get water on the first bench from three feet down, and upon the second bench from ten feet down. The first bench sometimes extends back from the river a hundred yards and sometimes a mile.

The first bottoms before the soil was broken up I presume had grass and weeds and vines and trees and berries and various other things of that character upon them. The sage brush is generally on the dry land. It is on the uplands. The uplands are covered with grass and sage brush, musquite and cactus.

1508 How far back the second bench extends depends entirely upon the formation of the country. Sometimes it is three or four miles.

The amount of land adjoining the Arkansas river in the State of Colorado that without irrigation or without any cultivation that originally grew any vegetation that could be used or that was profitable would depend entirely upon the season and upon the location and whether the grass was there in the first place or not. It might have been covered with sage brush so that the grass could not possibly get in there at all. Take the places where it is clear meadow, and if we have a good season it would produce hay. Speak-
1509 ing of the lands that were not under cultivation, there was but little of it that could produce grass tall enough to cut, but you couldn't cut it without clearing the brush and stuff off of it. You couldn't call it hay land.

You would go anywhere from ten to twenty-five feet before you would get water on the second bench. That has changed materially in the last few years. Back beyond the second bench it is practically the same thing, only a little higher.

Speaking of the amount of water that the several ditches especially referred to above actually use for the purposes of irrigation, in the ordinary season they use all they can get. That
1510 amount is limited by the season and by their decrees. Sometimes the season will not permit them to have any water at all, hardly, only a very limited amount, sometimes the season will give them their full decrees. There have been seasons that would give them the full amount of their decreed appropriations. This occurs at some season almost every year, but does not continue throughout the whole of the year. It exists whenever the rainy season happens to occur. It has occurred in April, May, June, July and August and during that particular period they could have the amount of water decreed to them. During the months of August, September, October, November and December there is not enough water in the river to give each of these parties the full amount decreed if the ditches that have older decrees demand their water. There would not be a sufficient amount to supply their decree. These ditches referred to use up to the amount of the decreed appropriation when it is in the river if they need it. During the last few years these ditches referred to have not been getting
1511 as much water as they wanted. There is great difficulty in distributing the water because the water is not in the river to give them, and when there is no water in the river everybody wants what is there and we can't let them have it. Then I close the gates down and stop them from taking it and give it to those it is decreed to or to the owners of the priorities. During the last eight years there have been some portions of the year that they were not getting the full amount of their decreed appropriations and the amounts they desired. This has frequently occurred at some time during the year. One year it went for a whole season pretty nearly. It went for three or four months at a time and sometimes for
1512 thirty or sixty or ninety days. The year I spoke of was the year 1901, or perhaps 1902. It was particularly a dry year. As to the proportion of the water that each of the ditches got, if there was water at all they would get their pro rata; if there wasn't water they wouldn't get any. There was some time during the season they would get from one-half to one-fourth or three-tenths of the amount they wanted. During the season they got variable amounts, and sometimes they didn't get any. There may have been other years nearly as dry as the year 1901. 1896 was a dry year. 1897 was comparatively dry. I don't think there has been more than two really good years in the last eight years when we had
1513 plenty of water. There are times always when some of the ditches are not getting any water. There has been a considerable portion of those six years when some of them were not getting any and others were not getting all they wanted.

Q. Then as a result the whole of these ditches do not get as much water as they want, as a general thing?

A. They do on the whole, you might say, but not every day in

the year. They get enough to make their crops. That is what they are after. But they don't get it always when they want it.

If there was more water the ditches would use more. The ditches use the most water in the spring and summer, until the first of September or even after. It depends upon their crops. We use water all winter for irrigation. Most any crop can be in-
1514 creased by using water during the winter. That is coming to be a recognized use of water during the winter season as well as during the summer season. If they had more water that wouldn't mean more land under cultivation. The use of water during the winter season is growing. There isn't any more land being put under cultivation, but the people generally get into the idea of using it for better crops. The months when there is the greatest demand for water I presume are April and May; that is in the seed time. The maturing season of the crop is not as bad as it is in starting a crop. Take some crops and they demand the water when they are maturing, but the main thing is to get them started. All crops demand water during the maturing season. August and September is the maturing season for cantaloupes and melons and fruits and sugar beets. Alfalfa of course cures three times a year. They generally try to irrigate alfalfa twice during the crop. There
1515 are three or four irrigations for the melon crop. I don't know exactly. Surgar beets can be made with three or four irrigations. The sugar beet and melon industry in the eastern part of Colorado is very extensive. Beet sugar factories are located at Rocky Ford and Sugar City. They are large industries and the sugar beets for these factories are grown along the Arkansas river. The cantaloupe industry has become very prosperous, permanent and extensive. Alfalfa is also grown along the river to a very great extent. At certain times and when the river is low the growth of these crops under these ditches practically absorbes the total flow of the river. The river is liable to be low in any month or any day in the year. There is no average about that.

1516 There is such a thing as a June rise. It may come this June but may not come next June and may not have been last June. It is not called a June rise in this country; we call it a rainy season, and it is liable to start at any time. We sometimes have more water during the season of the year when the snows are melting than when the snows are not melting. The snows begin to melt in March and they continue sometimes until the first of June. The melting of the snows is very irregular, depending on the season, whether it is hot or cold.

The reports in the State engineer's office show the exact amount of water used by the particular ditches referred to.

We sometimes have a dry season in the spring, we often have it in the summer months, we often have it in the winter months.

1517 I presume it is more liable to come in the summer months than in the spring. We used to think the rainy season began in May and June, but now we don't know when it begins, only when

it comes. It has been all the year round this year. This has been a very wet season. During the last eight years the dry season of the year has varied; one season we would hardly have moisture enough to bring out the seed. We didn't have it until it began to rain. Again, our dry season would be after our spring rains, in the summer. It is impossible to locate a dry season in Colorado as a permanent thing. It is as liable to be one season as another, and of course the rainy seasons the same way. The dry seasons of the year is when we want the most water for irrigation. The hot season here is July and August, and once in a while September is as hot as either one.

1518 In regard to the construction of those ditches, the decree is supposed to date when the work was begun. Most of these ditches were completed within a year. I think it would be safe to say that they were all completed within two years at least. I don't know, though. It is just simply a guess.

1519 In an official way I have been acquainted with the Arkansas river and its tributaries which receive water from the snow which melts in the Rocky mountains for the last eight years; in an unofficial way for twenty-five years. I am familiar in a general way with the snowfall in the mountains during the last twenty-five years. The snowfall during the last ten years I presume would average with the snowfall for the fifteen years preceding it. I don't see any difference. Some years it is very heavy and others light. My best judgment would be that the last ten years would be about an average with the preceding fifteen years. During the last year in certain sections the snowfall has been heavy During this year the snow fall has been greater than last year. I

1520 couldn't say that it has been greater this year than for a number of years last past. The average amount of snow fall last year was considerably larger than the previous year, and I think that was about as much as the preceding year. There was no unusual amount fell in any one section. Either two or three years ago we had a very heavy snow fall. I don't try to remember those things; there are too many of them.

Cross-examination.

By Mr. HAYT:

1521 I received my appointment as irrigation division engineer from the governor, but after receiving the appointment the governor exercises no supervison over my office. From the time I was installed in office I have made my reports to the State engineer. In case of a dispute with reference to the distribution of water, appeals lie from my decision to the State engineer, and my vouchers are approved by the State engineer and the original records made in my office are forwarded to the State engineer.

In speaking of the grade of these ditches and their elevation in my examination in chief, my answers were simply a mere guess

with reference to that—to the grade and the elevation of the ditches. I know the amount of land actually irrigated during any season from these ditches by the reports from the water commission-
1522 ers to me. In making the statements in my direct examination I didn't have those reports before me. I made an estimate. I have simply given my best recollection as to the amount of lands irrigated by these various ditches. Since I testified with regard to the grade of the river, I have had opportunity to look over my estimates, and I find that my estimate of the grade from Kansas to La Junta was 5½ feet to the mile; from La Junta to Pueblo it was 8 feet to the mile; from Pueblo to Salida it was 24¾ feet to to the mile; from Salida to Leadville 50 feet to the mile; and from Leadville to the source of the stream it was 232 feet to the mile.

There are ditches along the Arkansas river with appropria-
1523 tions dating back to 1859 or 1860. The earliest decreed appropriation that I can now recall is dated some time in the spring of 1859, four ditches,—the Hicklin A, Hicklin B, Hicklin C and Hicklin D, in district No. 15 on the Green Horn river.

As to the other appropriations from the Fountain river and other tributaries of the Arkansas, there is the Toof, with an appropriation of February, 1860, and then in April, 1861, there are the Warrant, Barnes and Baxter ditches. There are a great many 1861 ditches in district No. 14. There is the Arkansas Valley in 1861, and the Excelsior in 1861, and a large number in 1862, and in 1863 probably several hundred. I cannot at this time state the amount of water appropriated from the Arkansas river and its tributaries prior to the first day of January, 1862. Prior to January 1,
1524 1862, in district No. 10 there are nine or ten ditches, and a great many of them in district No. —. I cannot state at this time definitely the amount of appropriations made from the Arkansas river and its tributaries during any particular year. I do not remember of any ditch by the name of the El Paso Town Co. ditch. I think it was a Kansas corporation, but I don't know.

The headgate of the Buffalo ditch is on the north bank of
1525 the Arkansas river, about 18 miles from Lamar, Colorado. The largest portion of the water supplied to that ditch is seepage water. By seepage water I mean water that has seeped back towards the river after having once been applied to irrigation. In my official capacity I have had nothing to do with the distribution of the water between the claimants after it has been delivered to the ditches. Some of these ditches that have been termed here the larger ditches are what are commonly known as mutual ditches, more than half of them, I should think, and under these mutual ditches the water belongs to the stockholders of the ditch, and the owners of the right to use the water constitute the stockholders of the ditch.

All the ditches have waste-ways or sluice-gates near the
1526 dams so that there is a chance for the water to escape and go down the river, not only over the dams as I have testified but

by the sluice-ways provided for each ditch. None of the ditches in this water division take the water beyond lands drained by the Arkansas river and its tributaries, and the seepage water, whatever there may be, returns to the Arkansas river or its tributaries.

As to my duties in the prevention of the waste of water, I will say that the water commissioners are instructed when a canal or ditch takes water and is not using that water beneficially to close out at the headgate the amount of water he estimates is being wasted. That water goes back into the river again. So far as I am able I am careful to see that none of this water is wasted but that it is all applied to beneficial use.

1527 In the winter season the water is used for direct irrigation. This water acts in a measure as a storage for the coming season. If the land is well wetted down in the fall of the year it aids in the growing of crops during the next season. It makes a marked difference, and to some extent it is returning the water by way of seepage to the river during the next season.

In speaking of the rainy season and of high water in the river, I mean by that that I look for high water during the rainy season more than at any other time or from any other source. The rainy season is very indefinite. It may come as early as March and sometimes as late as September or October and sometimes not at all.

1528 In testifying in my examination in chief as to when work was commenced on these different ditches, I was speaking only from my records and not from my personal knowledge. In speaking of the amount of snow fall in the mountain draining to the Arkansas river and its tributaries, I was simply giving my judgment based upon such records of the State engineer and other reports as I have received from time to time. In recent years the melting of the snow has been hastened so that the water runs off more in floods than theretofore. I attribute this sometimes to a warm rain and sometimes to an excessively hot spring. I am one of the cranks who do not believe that the cutting of timber off the headwaters of the river has any effect on it. The length of time the snow lasts

1529 depends entirely upon the snow fall and the winter. For the last two or three years the snows have been going earlier than usual. This year we have had plenty of water all the season. It came mostly from rainfall.

There are some old ditches as well as some new ditches that haven't taken out any decrees for water. I have one in mind that claims water from 1861. Some of these old ditches that were constructed prior to the adoption of the constitution of the State of Colorado have refused or have at least not taken out decrees for their water rights.

1530 I know very little of my personal knowledge with reference to the State ditch near Cañon City. I have crossed it in wagons. There is a distance of a mile and a half or two miles between the upper end of the ditch as completed and the proposed site of the headgate of the ditch. The surveyed route between

the upper end of the ditch as constructed and the place designated to take the water from the river is nearly all rock—solid rock, very steep. It is the Grand cañon of the Arkansas, where the
1531 cost of construction would be enormous. In speaking of the cost of the completion of this ditch in my direct examination, I wish my answer to be confined to the three miles of ditch that had once been completed and needed reconstruction. I believe I stated in my answer that it had filled in with debris and other stuff and it was just simply a matter of cleaning it out. The ditch could not be completed except by the expenditure of an enormous amount of money. I think it would cost somewhere between two hundred and fifty and three hundred thousand dollars to complete the ditch.
1533 This is a mere estimate based upon what I know of the construction of other ditches.

In stating that the cutting off of timber at the headwaters of the river has had no influence upon the snow, I meant more particularly as influencing snow fall. I spoke with reference to the precipitation not being influenced by the timber. The denuding of the country of its forests takes the shade away from the snow and the snow naturally melts slower in the shade than it would in the sun. The same holds true of snow on the north hillsides and
1534 deep cañons where the sun does not reach it. The largest per cent. of timber has been cut off during the last twenty-five years. In the earlier years the greater portion of the country constituting the drainage at the head of the Arkansas and its tributaries was covered with timber. The greater portion of it is now barren of timber. Take for instance the head waters of the Fountain from Colorado Springs up to the divide, prior to twenty years ago there was fine timber there all around the base of the mountains, heavy low cedars and junipers that covered the ground entirely. It is gone now. The same is true all along the river.

There has been this kind of a change in regard to flood waters in recent years: The water runs off much faster than it used to on account of the streams having been enlarged by constant floods, and there has been gulches or draws made where there were none years ago, all over the whole country there, and they take the precipitation away much faster than it did before when the country was almost level or there were no broken places in it. The beds
1535 of our streams have enlarged to a great extent so that the time of the flood waters is much shorter, that is, the particular run-off is much shorter than formerly. These new ravines and hollows forming these smaller streams are made from a great many causes—from cattle trails, from roads that have been built through the country and wagons that have gone over prairies and left a trail in the mud that has afterwards made an enormous ditch or gulch. It seems as the country gets settled up these things become more numerous. The destruction of the underbrush and the making of trails, etc., would come under the same head. The larger ravines have grown still larger all the time. There are some very

noticeable instances close in here. For instance, this gulch that caused this Eden disaster up here a few days ago, I remember when there was no more gulch there than there is on this floor. The mountain river here in 1885 and 1886, we used to cross it on a little
short cottonwood log, and now it is a thousand or fifteen
1536 hundred feet wide at that point. Many of these ravines in
the earlier days were covered with buck brush, cactus, grass and such stuff, and a little farther back toward the hills the river was covered with cedar and pinon. There is nothing but the cedar and pinon left; the other is pretty scarce; it is eaten off and killed by stock, so that the mountain valleys have been practically denuded of that sort of growth of late years, and by the cultivation.

We usually distribute the water according to the priorities,
1537 but to this rule there are some exceptions. For instance, if
the water in a tributary is such that it can reach the river in a sufficient amount, we close out the later priorities. If that water won't reach the river, we don't close it out. That is governed by the condition of the stream. The water in all the streams in this country rises and falls when the stream is low. It will sink in one place and rise in another. On most all of our tributaries that is the condition, and when it sinks we leave it in the river; we don't take it out. We leave it where it will do the most good. In actual practice the rule in reference to allowing water to be used on these tributaries in preference to prior rights on the stream is to allow it to stay there, under those conditions. In recent years there has been no water to cut out from many of these streams; it would sink back
and we would allow the people up stream to use it. It
1538 wouldn't show to the river at all, and sometimes not within
ten to twenty or thirty miles of the main river, and yet at the head waters of these streams we would allow them to take that water and use it. Some of the streams would not show within fifty or sixty miles of the river; they would be dry, with plenty of water at the head of the stream. It frequently happens that the owners of ditches on the tributaries are allowed to use the water near the heads of the tributaries in preference to those having a prior right to the use of the water from the main river. That water wouldn't be allowed to continue on its course. It would be impossible to get it to the river at all.

Cross-examination.

By Mr. CAMPBELL:

1539 There is a State reservoir near Monument, on the Monu-
ment river, which is a tributary to the Fountain, and the Fountain is a tributary to the Arkansas. There are two State reservoirs in this division, one being at Salida. In the district that I represent the lands could raise a crop without irrigation some years. From one year to another, they could not. It is absolutely necessary to have the waters of the Arkansas river to irrigate these lands

that I have testified to in order to raise productive and profitable crops. If from any cause these lands could not get the waters from the Arkansas river they would go back to their original state again where they were before the white man ever saw them, or worse.

1540 A cubic foot of water, as I have used the term, is 7½ gallons passing a given point in a given time. An inch of water varies in different countries. In Colorado it takes 39½ inches to make a cubic foot. This refers to statutory inches; it is not cubic.

1541 As to the amount of water it takes to irrigate an acre of land, this varies in different localities in this division. At different places in this division it takes from one-half to two acre-feet to produce a profitable crop. An acre-foot of water is an acre of water a foot deep over the entire surface of the ground. It depends entirely on the locality. We generally assume that a cubic foot of water per second of time will go over 50 acres of land if we had it continuously for the season.

The method of obtaining the decrees I have testified to is as follows: You first must select your site, survey your ditch and have a copy of that survey made and sent to the State engineer's office and a copy filed with the county clerk, and then that ditch must be completed, and you go before the district court with your evi-

1542 dence and the court will grant you a decree upon that evidence. This proceeding is initiated by a petition to the court. If A has a ditch he goes and petitions the court to have it decree the amount of water that he is entitled to, and the date of his appropriation. When the ditches in this division were all completed the court appointed a referee and this referee notified the claimants of water throughout the particular district that at such a time he would hear the evidence as to the amount of water they claimed, and their rights. Each man claiming a right presented all the evidence he possibly could before the referee. The referee then granted upon the petition a certain amount of water, and that was then taken to the district court for review. The district judge passes

1543 upon it and confirms these decrees. Then the court issues the decree. The other parties who are interested are brought into court by a notice served upon them or by publication. The decree dates back to the time when the parties began work

1544 on the ditches. The survey of a ditch might have been made but the work might not begin until the year after.

There is a large amount of water gets back to the Arkansas river from the ditches in respect to which I have testified. I cannot give you the percentage. Very little water in these ditches is lost by evaporation. The best way to explain this is, you take a ditch here, for instance, that goes around town, called the Bessemer ditch. There is over 60 feet of return water from that ditch every day in the year, whether the water is in the ditch or not. It never stops. There is over 60 feet that never ceases to run, of return seepage. Now,

there are numbers and numbers of days in a year that that
1545 ditch never has any water in it at all. It doesn't affect the seepage whatever. I don't know what the average run would be in that ditch, that is, per day. I do know that there is about 60 feet of return seepage every second of time from that ditch. I don't think there is any loss from the evaporation in the ditches at all to amount to anything. The amount of water in these ditches after it is applied on land, not lost in evaporation, seeps back to the river. Of course after it is applied to the land there is a big evaporation, but not in the ditch.

1546 I am acquainted with the topography of the country along the Arkansas river in Colorado, and have paid considerable attention to irrigation, and know a good reservoir site when I see one. There are a great many reservoir sites along the Arkansas river in the State of Colorado, where reservoirs could be constructed to catch the flood waters and surplus waters. Approximately twenty-five or thirty—maybe more. These reservoirs, if constructed properly, would easily take care of a hundred thousand acres of land. There is now sufficient flood water escapes every year and goes down into Kansas to fill the reservoirs I have referred to. Provided reservoirs were constructed in Colorado along the Arkansas river
1547 and its tributaries to catch the flood and other waters which now escape, taking one year with another, it would put from two hundred to two hundred and fifty or three hundred thousand acres under cultivation. There is an awful lot of flood water that now escapes. At the last floods we had here an enormous amount of water went out of the State. I think it would be practicable to impound waters which now escape that would irrigate at least 100,000 acres more than are already irrigated in Colorado. I don't think it possible under any circumstances to impound all of the flood waters of this State, but it is practicable to catch an amount sufficient to irrigate a hundred thousand acres of land in addition to what is already irrigated along the Arkansas river and its tributaries in Colorado.

Redirect examination.

1548 By Mr. SMITH:

The 60 feet of return water that I spoke of coming from the Bessemer ditch back into the river comes out of the ditch and shows itself in the river. It runs into any gulches or arroyos, and then we measure it in those little gulches back to the river. In
1549 measuring the volume of water we take all those gulches and arroyos returning from the ditch to the river.

The Buffalo Creek ditch is the one closest to Kansas. I think there is no dam constructed there, unless it is a sand dam,
1550 just a temporary dam. The dams for most of these small ditches are built a few inches below what would naturally be the bed of the river, and they could very easily draw the water

out of the dam in these small ditches. At Rocky Ford where the Amity dam was constructed it was 22 feet to bed rock in
1551 the bed of the river. At the town ditch west of Las Animas the rock bottom is very shallow or only a few feet below the river bed. Between the surface of the river and the bed rock it is all gravel and sand, and that is filled with water, and there is a current to that water. This water percolates down and goes with the stream, very slowly. The bed rock back from the river
1552 below the surface of the bottom lands is from fifteen to sixty feet. It is not level. It goes in what we call waves. It will run a long distance deep and then comes right up to the top and then it will sink right down again. This is why the water rises and lowers again there. This water beneath the surface is forced up this shallow reef. It will come to the surface and flow with the river, while below that the river will be perfectly dry. I think there is some difference at which the bed rock is found
1553 between the north and the south side of the river. It is the deepest on the south side. On the south side of the river it dips to the river; on the north side it sometimes dips to the river and sometimes away from it. In most places about thirty miles east of Pueblo, then for about thirty miles, the rock appears to dip from the river, and there is nothing to indicate that it dips toward the river. Then from that east it comes back to the river
1554 again. The wells along the river in most cases are found in the gravel and sand, and I know of places where the sand is thirty or forty feet deep. Sometimes we go through three or four or five feet of fine sand. It doesn't appear to hold the water like the gravel, which is always water-carrying gravel.

Where the water is spread out on the fields from the canals I presume it starts right away as seepage toward the river. I
1555 presume this from the slope of the ground. When it slopes to the river I presume as soon as that water gets down it begins to hunt its level and will gradually work to the river. The water in this water-bearing gravel comes either from the river or from the ditches on the side, so that portion of the seepage gets into the water-bearing gravel. The seepage that goes into the water-bearing gravel is small as compared with the water in the river.

We know that the Buffalo canal is fed by seepage because there is no river water where the headgate is and away above it. The water seeps into the river and makes a channel. We don't call that river water. Wherever the water strikes the river it will form its own channel until it is captured again. Even though the water that supplies the Buffalo ditch might have been forced to the
1556 surface of the river by the reef, still it would be seepage. The water for the Buffalo ditch would naturally be both from the water in the water-bearing gravel and from the return waters. It would take an acre foot at the least calculation to make the
1557 average growing plant upon an acre of land. I don't know how much water it takes to irrigate an acre of alfalfa. There

is no farmer that knows that himself. He floods his land, and that is all he knows, if he has the water to do that. I am not a practical irrigator myself. I know how deep it ought to penetrate, but I don't know each irrigation whether they have got enough water. If he has sufficient water to irrigate his land it ought to penetrate until it reaches a lower stratum. You take a run-off here a foot deep and it wouldn't go into the ground six inches. You take the same amount of water and spread it over the land right and it will go eight feet or more. That is why I say they don't know
1558 how much it takes to wet it. It depends very largely upon the condition and the depth of the soil, the amount of subsoil, and all that sort of thing. Between Cañon City and the State line we have measured the water in the draws and arroyos and all return places and we know what the return seepage is. These measurements show that between Cañon City and the State
1559 line in the years 1897 and 1898 the return seepage was 392.9 cubic feet per second of time. What I have said in reference to the seepage or return flow of the Arkansas river does not apply to the tributaries of the Arkansas river in the same proportion. As to them, it is less. A few of them deliver a great deal and others very little. The principal seepage or return flow from the canals is into the river itself.

Redirect examination.

By Mr. LOOMIS:

As to the extent of territory in the Rocky mountains that is included in the drainage area of the Arkansas river and its tributaries, I can state it approximately from my records. The State engineer has it. It is a little more than one-quarter of the State. The snow falls in the mountains from the first of September to
1560 the first of *September*. It is liable to fall any day. It begins to melt in February and will then freeze and then thaw. Generally, melting sufficiently to cause water to run in the streams begins about the first of March. By the first of March or prior to that there is very little melting of snows. In April and May the snow commences to melt so as to cause water to flow in appreciable quantities. The snow that falls upon the mountains from September to April is some of it stored. A great deal of the early snows that fall are absorbed right there in the mountains. In September, October and November, and even in December, there are large amounts of snow that fall that will melt and is absorbed in the mountains at the time and you never see it. There is no run
1561 off to it. There is an appreciable quantity of snow melting in September, October and November. It commences in April and would sometimes end about the first of July, depending on the season and the amount of snow. The snow that melts in September, October and November does not furnish any run-off; it is absorbed by the mountains. The snow that falls from September until March re-

mains in the mountains in some form of moisture, or evaporates.
1562 If there should be a heavy snow in September and a warm rain on it, it would all come in together and doesn't run from the mountains in any appreciable quantities, ordinarily. If the conditions are favorable the precipitation upon the mountains falling after September usually remains in the mountains until the thaw begins in the spring. As to the time when the greatest thaw occurs so as to carry the water, that depends entirely on the season, whether it is a hot spring or a cold spring. Take it in an average season for the last twenty-five years, it would occur along the last of May and first of June. That is true in ordinary seasons, but is not always
1563 true. Speaking ordinarily and taking it year after year, the most of the water will come from the mountains into the Arkansas river in the latter part of May or during the month of June. The seasons vary here so much that we may have a rain that would produce a flood, and at another time it would take off the snow in a hurry; but if the season is an ordinarily warm season throughout or if it happens to come that way the snows will melt very regularly and the volume will reach us in May or the first of June. It all gets down by the month of September, and even before that. I didn't mean to say in my cross-examination that the snow melts more rapidly now than formerly. It will in certain cases. The same piece of ground where this timber was cut off, some winters the snow will fall there and freeze and thaw and freeze until I have driven wagons heavily laden over that snow and over the same ground, and that snow wouldn't melt until very late in the season. Another year may come and that same snow
1564 will be gone before the first of April, on the same ground. The cutting of the forests upon the mountains within the drainage area of the Arkansas river does under some circumstances cause the snow to melt more rapidly than formerly. So, year in and year out, I will answer your question by saying that in some years it will melt more quickly and in some it won't. I don't know for how many years during the last ten years the denuding of the mountains has caused the snow to melt more rapidly. I think last year it melted a little faster than it would have done if we had had plenty of timber all over the country. For the years 1902
1565 and 1901 I don't remember. If the cutting of the forests does cause the snow to melt more rapidly, then the water ought to come down in greater volume, and those times occur in May and June. There is more water flowing down the Arkansas river from snows in May and June than in other portions of the year, but I will not say that that amount is greater than the amount produced by rain. The greater part of the water flowing in the Arkansas river is obtained from the rains rather than the melting of snow. I should think that during the spring and summer months probably seventy-five per cent of it comes from rains. In order to know what proportion comes from rains and what proportion from melting snows the year through we would have to know what proportion

of water was stored in the mountains each season by rains and
1566 what was stored by snows. The heavy rains come at any
time from spring until fall, for six months. From the first
of April or the middle of March to the middle of September. If we
have any rains outside of these months it is an extremely rare
1567 case. The rainfall begins with the middle of March and is
known to go as far as the middle of September if it does not
1568 turn to snow. It has done it a good many times.

Examining Complainant's Exhibit A–5, I should say from this record it appears that there is a much greater volume of water flowing in the Arkansas river at Cañon City during the months of May, June and July than during any other months of the year.
(Objection.) It appears from this record that that was from
1569 1888 to 1893. I have no doubt but that in June and July
there is more water flowing in the Arkansas river at Cañon City than at any other time. I have never made any other statement that there wouldn't be. It is liable to come from any source. I have not stated that it comes from melting snows.

In stating that it took a cubic foot of water continuously applied to irrigate fifty acres of land for a season, I meant by the words "for a season" from the first of March until the crop was made.
1570 This would apply to all sorts of crops. I make the assertion
that a cubic foot of water per second of time is sufficient for an acre of land, regardless of what crop is put on it, whether it begins the first of January and ends the first of January or whether it begins the first of May and ends the first of September or not. (Objection.) That cubic foot of water is used to make a crop put in the ground. These sugar beets are planted in May. It will be from the time the
seed was put in the ground until that crop is ripened in Sep-
1571 tember. The other crops grown in the Arkansas valley here
are wheat, corn, barley, melons of various kinds, flax, oats, sugar beets, apples, bush fruits of dozens of kinds, sugar cane, sugar corn, kaffir corn, hay, alfalfa, and wild hay. Alfalfa is never planted but once. Fruit crops are planted but once. Sugar beets are planted in the spring, in the month of May and some wheat is planted in May and some in September. Only a very small amount, what we call hard wheat is planted in September. Wheat is a small crop compared with some others. Most of the crops we raise here are spring crops, and they begin to mature in June and from that until September, and nearly all are matured by September, and most of the water
that is used for irrigation purposes while these crops are grow-
1572 ing is used from March to September. The hottest season is
in July and August. I presume that it has an effect upon the quantity of water used in the irrigation of crops.

I have known the temperature here to get I think 100 in the shade. It is hotter down at the Kansas State line than it is at Pueblo.

I think there is some evaporation of water in the river, but not

very much. I don't think there is very much in the canals.
1573 There is a certain amount of evaporation when the water has been spread over the ground for the purpose of supplying moisture to the growing crops. I am not positive how many acres of land are irrigated from the waters of the Arkansas river and its tributaries in the State of Colorado, but as nearly as I can recall there is something like four hundred thousand acres. It is a matter of record in the State engineer's office. I presume that about seventy-five per cent. of that is irrigated during the hot months of the summer. The waters of the Arkansas river during these hot months are distributed over this large area of land for the purpose of getting moisture to the growing crops. The number of days that the water is used depends upon the crop. You understand some crops take more water than others. The crops that are supplied most frequently with water I presume are irrigated three or
1574 four times between March and September. I don't think it is applied oftener than that to any crop. About once a month. Applying this water to this large area during the hot months causes a great deal of evaporation, I presume, but I am not able to state the amount. We raise large quantities of alfalfa, wheat and other crops on this area of land, and immense *of* crops if we have a good season, and all these crops absorb more or less moisture from the ground.

My busiest season is the year round, from January to January. I am not in the field only when I care to go. My duties are office duties, and it absorbs all my time here, unless there is something comes up that needs my individual attention. I depend upon
1575 my subordinates to look after matters in the field. Each subordinate in his own district is required to go over portions of the river from day to day. We see that the water is properly distributed for the purpose of settling all disputes. The bulk of the disputes get to me, and these come thickest in May, June, July and August. The want of water causes them to come to me thickest at that time. These are the months when there is more scarcity of water and when the water is used most generally along the river, and when they get into trouble mostly about the water. During these months I am not able to supply them all with the
1576 water they need. I have always been able to furnish them with water enough during these months to make a crop. I have never known a time when I was not able to give them water enough to make a crop during these months, but I have a great deal of trouble distributing the water between the different lands because each one wanted to get as much as his appropriation called for, and that led to the trouble. I don't think that they always got as much as they wanted. I don't think that they got enough to make as good a crop as it would have been if they had had more water. In order to give them all I could I took all the water from the river that I could possibly get, and I didn't allow a bit of it to get away if I could help it. We had special orders not to allow any to go
1577 down the channel into Kansas. These special orders originated with me.

In speaking of the water being captured again after returning to the river as seepage, I meant to say if the appropriation nearest to the water was entitled to it it would get it. The water that would gather in the river below the dam I don't think some of it would ever get to any dam whatever below; it would be taken into a small ditch. It would go down until it struck some other ditch and it would then be captured by that ditch, if it was entitled to it. If a dam should take all the visible water above it and put it into a ditch some of it would get back again and some of it would go under the dam, but the next dam or ditch would catch it if it appeared,
1578 if there was any of it in sight. Then if any happened to go by again from that ditch or dam and went down the river a ways another dam or ditch would capture it again if it appeared, if there was any of it in sight, and that would be kept up from one end of the river to the other, until the Kansas line was reached, and then Kansas would get it. There is some left and Kansas gets it.

Q. You do not aim to have Kansas get it?

A. Well, that is my own business, you know. That don't come from anybody but me. It was a joke.

Q. Did not Professor Carpenter promulgate the same doctrine?

A. No, sir, he did not.

Q. You are quite sure of that?

A. Yes, sir, I am. I will shoulder anything that I do. I am not sticking it onto somebody else. No, sir, that was simply a joke on the river.

After the water leaves Rocky Ford it is subject to capture
1579 several times. It is not subject to capture above Rocky Ford, because we have generally some of it up here.

The water we take from the river for irrigation is distributed over land back from the river, vaying from three to fifteen miles. (Objection.) The State reservoirs that I have spoken of are owned by the State of Colorado. One is located in El Paso county, above Colorado Springs, a very small one. There is a very small one on the south side of the Arkansas river above Salida. I don't
1580 suppose they would cover over five or ten acres. I presume the deepest point in either of them, if full of water, would be fifteen feet. The reservoir up here near Colorado Springs is used once in a while for the upper part of the Fountain valley, for irrigation purposes. It is a question as to whether the State owns that reservoir or not, or whether it has abandoned it or not. I understand the one up on the Monument creek in El Paso county cost fifty thousand dollars. It was built by the State, and if I am not mistaken, in the year 1886. It has been used for irrigation
1581 purposes since that. It is used very little for irrigation purposes. We have never turned it out more than once a year, and then it would only go into two or three ditches, and a very small amount of land under them. The water comes into the Monument reservoir from the water shed of upper Monument creek, which is a tributary of the Fountain, and this is a tributary of the

Arkansas. This is within my jurisdiction, and I look after it, but we do not charge anything for the use of the water. We just give the use of the water to the farmers. I don't know whether
1582 any repairs have been made upon it. The other reservoir on the South Arkansas is up in the mountains about one hundred and ten miles above Pueblo, and is supplied from the water shed of the South Arkansas. This reservoir was built by the State, but when it was built and how much it cost I do not know. It is within my jurisdiction, and is used, if at all, for irrigation, supplying three or four small ditches on the South Arkansas. It is
1583 still used for that purpose. There are no other State reservoirs within my jurisdiction, but there are nine or ten big reservoirs. Three of them are used for manufacturing purposes and the balance are used for irrigating purposes. Some of them get their supply from the St. Charles, one of them from Lake creek, and all of them get their supply from the tributaries of the Arkansas or from the river itself. These reservoirs are not allowed to be filled at any time of the year but only when there is a surplus of water for all decreed ditches. This time generally occurs at different periods in the months of March,
1584 April, May and June. Sometimes it is in August and sometimes it has occurred through the winter months that they would take some water. The only times they have ever been filled, it only ran during the months of May and June, or a part of July maybe. It is customary to fill them each year if we have the water, but we do not have the water to fill them usually each year. I think in the eight years last past we have never failed to fill them but two years. I am not positive. We have never filled all of them to their capacity. Some of them have been filled to their capacity, but there are others that we have never filled, because we didn't have the water. They are filled when there is a surplus, practically then during the flood season, and when the water is above
1585 the normal stage in the river. We usually get our best run of water when the water is at the highest, and that occurs sometimes in May, June and July. Of course the other months have in that period of time furnished some reservoir water. I think four of the largest reservoirs were never full. These are the Ne Gronda, the Nee Sopah and Neoshe. These are located west of Las Animas, under the Fort Lyon and Kicking Bird. The Kicking Bird is a feeder of the Fort Lyon canal. The Laguna reservoir has a capacity of 185,011,890 cubic feet. These reservoirs have no decrees
1586 but have filings. (Objection.) These filings consist of a petition for a decree, claiming the amount of water designated. (Objection.) This is based upon the supposed capacity of the reservoir. They are entitled to water before they get their de-
1587 crees. I have to determine when they get water and how much they get. I don't have to be informed of the amount of the appropriation the reservoir company has claimed. When they claim the water we give it to them until they are full, or what

they want. It makes no difference to us what the amount is they claim. We govern the reservoir's water according to their filings, which we get from the State engineer's office. The companies
1588 notify me here that they want so much water and make claim for it. I get the information from the State engineer's office
1589 that they are filed there, and allow them to have the water. It is absolutely unnecessary for me to have the information of the
1590 amounts claimed by the reservoirs. There are certain rights recognized in reservoir companies that have built their reservo-rs and made application for filing, from companies that have made no reservoirs. We recognize that priority, although I presume there is no legally established priority. It is not necessary to know the amount they claim and are entitled to in order to determine between these reservoirs; that doesn't make any difference at all; it makes no difference whatever in the surplus that goes
1591 into them.

The next reservoir after the Laguna is the Queen, (objection), whose capacity it 1,418,182,920 cubic feet.

The next is the King, whose capacity is 796,233,732 cubic feet.

The next is the Neoshe, whose capacity is 2,614,325,240
1592 cubic feet.

The next is the Nee Gronda, whose capacity is 2,491,806,240 cubic feet.

The next one is the Nee Sopah, whose capacity is 1,022,113,620 cubic feet.

The next is the Minnequa, whose capacity is 57,275,000 cubic feet.

The next one is the Savard, whose capacity is 63,000,000 cubic feet.

The next one is No. 3, whose capacity I haven't got.

The Savard was built a couple of years ago, but was not finished. The Minnequa was built, I presume, twenty years ago or more. The Laguna has been built since some time in the late '80's and the others have been built some time in the '90's. The Minne-
1593 qua and the Savard are not used for irrigation purposes, but are owned and controlled by the Colorado Fuel and Iron Company and are used for manufacturing purposes (objection) and are located almost within the limits of Pueblo. The Laguna is situated below Rocky Ford and is under the Lake canal. The Neoshe, Nee Sopah, King, and Queen, belong to the Great Plains Storage Company and are situated north of Las Animas. There are several other reservoirs that I have not mentioned and that I haven't got the records of at all. There is the Sugar Loaf reservoir, built for manufacturing purposes, north of Leadville, which is a very large one; there is a reservoir called No. 5, that be-
1594 longs to the Colorado Fuel and Iron Company, that is not completed. This is for manufacturing purposes. There is one on the Huerfano, but I don't know its dimensions. It has a filing but no decreed appropriation. It is used for irrigation.

What proportion of the Arkansas river as it ordinarily flows below the Grand cañon is derived from the tributaries which run into the Arkansas river below the cañon depends largely on circumstances. The bulk of our water is furnished from flood waters, and these flood waters as a rule come from the tributaries or side streams. The rate of flow of the Arkansas river other than that is very small. The flow of the Arkansas river as it comes out of the Grand cañon is very small, unless it has been augmented by floods from the side streams. Some of these side streams furnish water from the melting snows in the mountains—all of them more or less. All the water coming through them normally is mountain water.
1595 The last tributary west of the Kansas line I think is the Big Sandy. Up to this year it never discharged but very little, if any, into the Arkansas river, except when there were floods in it. The continuous rains have caused the discharge this year. We have had heavy rains in this vicinity this year, and that accounts
1596 for the unusual flow of water in the Arkansas river. The measurements that have been made of the Arkansas river and its tributaries are on file in the State engineer's office and we consider them very accurate. (Objection.) These estimates
1597 were made under the supervision of the State engineer. The party who makes the gauging is a man deputized by the State engineer for that purpose. The gaugings have not been kept up regularly expect for the last two years. They have been called for by the ditch associations ever since I have been in the office. We have had them ever since I have been in the office, but they have not been as accurate as the present State engineer has
1598 caused them to be. The records prior to two years ago are not as complete as they have been recently. What was done before was accurately made, but they have been growing
1599 more complete all the time. The Government has had a party here who has measured these streams for a long time. The present one is Mr. Fellows of Denver. I am not able to state the carrying capacity of the Arkansas river with its banks
1600 full at any point within my jurisdiction. It depends upon what the banks are. The Arkansas river through Colorado is wider now than it was in former years. The average width between Pueblo and La Junta would be fifteen hundred feet. Between La Junta and Las Animas it is a good deal wider, and between Las Animas and the Kansas State line still wider. But in the early years it was narrower than these estimates I have given.
1601 The water gets into some of these reservoirs that I have mentioned through canals and into some of them through the natural creeks. They are all supplied from the Arkansas river or its tributaries. I think the first use of the reservoir water from the Twin Lakes reservoir was made about five years ago, and the first water, I think, that was used by the Great Plains Storage Company reservoir would probably antedate that a few years. The Laguna reservoir would, I think, antedate the Great Plains reservoir

a few years, and then the Huerfano reservoir was used about thirty years ago.

1602 I have examined Complainant's Exhibit A–14, and will say that I had that prepared under my supervision, and that it is a correct statement of what it purports to show upon its face. My impression is that it gives some filings as well as decreed appropriations.

(Exhibit A–14 introduced in evidence. Objection.)

Recross-examination.

By Mr. CAMPBELL:

1603 Complainant's Exhibit A–14 was compiled under my direction from data which is kept in my office, which the statutes of the State of Colorado require to be kept. I have examined it, and it is a faithful transcript of the records in my office which by law are required to be kept, as near as we could make it. If there are mistakes in it we don't know it. It is as nearly perfect as we could make it.

Recross-examination.

By Mr. HAYT:

1604 I don't know that the law requires me to keep any record of these decrees and filings, but they are certified up to me by the district clerk every time they are entered on my books. A decree is the decree certified up by the district court, and a filing is a petition made in court for a decree—the commencement of

1605 a suit to determine the right to the water. I don't mean to say that Exhibit A–14 contains all of the filings in the State engineer's office. I think it contains three or four on which decrees had not been entered. I think I had a few in the office and just entered them up on there, but it was not intended for filings at all. There are lots of filings in the State engineer's office, in this division, that are not in my office at all. This paper simply contains

1606 the decrees as certified to this office, and there may be two or three filings. (After examining Exhibit A–14) I don't think there are any filings in this whatever. The appropriations which I spoke of, made prior to 1861, are shown in this statement. There are certain appropriations prior to January 29, 1861. With their amounts they are as follows:

The Flannigan ditch, April, 1860, .74 of a cubic foot per second.

The Cheyenne ditch, 1860, 3 cubic feet per second.

The Hardscrabble ditch, May 1st, 1860, .93 cubic feet per second.

The Toof, February 20, 1860, 4 cubic feet per second.

The Hicklin A., spring of 1859, .6 cubic feet per second.

The Hicklin A. of Mrs. Hicklin's first priority, spring of 1859, .1 of 1 cubic foot per second.

Hicklin B., spring of 1859, 1.8 cubic feet per second.

The total amount of these certain appropriations is 11.14 cubic feet per second of time.

1607 All of the streams that drain into the Arkansas river have their source in the mountains except two or three. I should say that one-fourth of the Arkansas river drainage is in the mountains, and about three-fourths east of the mountains, between them and the Kansas line. In speaking in my direct examination of the snow fall that fell upon this drainage I had reference simply to the snow fall in the mountains and not that upon the drainage

1608 east of the mountains. In stating in my direct examination that a cubic foot of water would irrigate fifty acres of ground if it flowed continuously, I did not mean that it would require a continuous flow of a cubic foot of water to irrigate fifty acres of ground. We mean by that expression that if the party who owned the land could have the water whenever he wanted it. That varies in this division, as I wanted to explain to him, from 25 to 100 acres, but an average would be about fifty acres as a rule. I have already stated that it is only necessary to use this water three or four times during the year. I cannot say to what depth a cubic foot of water per second of time will cover fifty acres of ground, per month It would go pretty deep if it would go down in the ground. I should think without going into the ground at all it would cover it about

1609 fifteen inches deep—all of that. So that a cubic foot of water would irrigate much more than fifty acres. On the Beaver creek they claim a foot of water will irrigate only twenty-five acres of land, and they made a petition in court and got a decree for that amount. In other places a foot of water is abundant for one hundred acres of land. I believe if a cubic foot could be had whenever you wanted it and applied in certain places it would irrigate 150 acres of land in certain districts. In certain places a cubic foot of water per second of time would irrigate that much on an average if it could be had whenever it was wanted. That implies that it is not wanted continuously. If it runs continuously it will irrigate more than fifty acres. I don't believe it will irrigate more than 150 acres on an average in this district, for this reason: There are a large number of decrees taken out where the claimants have made sworn statements that it would take a cubic foot of water continuously to irrigate twenty-five acres of land. They claim

1610 that the conditions are different. I believe that east of here it would irrigate 150 acres of land if it ran continuously. On an average in this whole drainage of the Arkansas river and its tributaries I don't believe it would irrigate over 100 acres.

The book I used to refresh my memory in testifying in regard to these reservoirs was simply a little memorandum pocket book I have. It is not an official record at all, but simply a little memorandum I have for my own personal convenience.

Q. Now, I didn't get this quite clear in my mind with reference

to the waters going down into Kansas. You said something
1611 about a joke. I would like to know exactly what you mean by that.

A. I can best give you that by an explanation, if you want it. Sometimes they call for water at the Amity canal, for instance, and I will want to know from the water commissioner how much of that water he is letting go into Kansas, and he will probably reply back that there is none of it, and I will tell him back he had better not let any go there while he is hollering for his decree.

Q. It is a mere matter of joking, is it not?

A. That is all, between myself and the water commissioners.

Q. You don't mean to say you do anything to prevent this water running into the State of Kansas, do you, except as it might be supplied to those various ditches?

A. That would be all.

In reference to these reservoirs that I have said belong to the State of Colorado, there are two of them.

Q. Do you know whether these reservoirs belong to the State or whether or not the State simply made an appropriation to aid in the construction of the reservoirs?

A. Individually and privately, I don't believe the State has anything to do with it. I think they have lost all the right they ever had to them.

This reservoir at Monument is a very insignificant affair. I don't think it is kept in repair. If it is I don't think the State has ever appropriated anything for the purpose of keeping it in repair. The water is turned into the Monument creek when we take it out of that reservoir. Monument creek is a tributary of the Fountain, and then the first ditch up the Fountain generally gets the water. This water is held in the reservoir in flood times and turned out into the creek in times of low water. In reference to this little reservoir in Chaffee county, it is claimed by people that the State owns it. I don't know anything about the ownership except that we gov-
ern it as if it belonged to the State. I merely know that the
1613 State made an appropriation to aid in its construction. That is as far as my information goes. When we turn the water out it goes into the South Arkansas river, a tributary of the main Arkansas river, and that is taken up by a very few ditches, principally on the South Arkansas river. It goes to supply the priorities along the South Arkansas river. As to whether the figures I gave in giving the capacities of these private reservoirs designate the number of cubic feet in the reservoirs or the number of gallons, I would say that I find there are several reservoirs filed for so many million gallons and some of them for so many cubic feet. It does not say cubic feet per second of time, because cubic feet in a reservoir I presume is different. It don't state, and I didn't take the time to look. Some of them are cubic feet and some are gallons. I
am not absolutely certain which of these figures that I have
1614 given represent cubic feet and which represent gallons. I know that in some of them it represents gallons and in others

it does not. Seven and a half gallons, approximately, constitute a cubic foot. I think a cubic foot in a reservoir is different from a cubic foot per second of time in a ditch. I think it relates in a reservoir more to the acre foot. These reservoirs that are used for manufacturing purposes use the water for manufacturing purposes and then turn it back into the river. A large percentage of
1615 it goes to the river again. What they use is exhausted by steam and evaporation. As to this little reservoir in Chaffee county, I know as a matter of fact that it is not under the control of the board of county commissioners in Chaffee county. I know that they tried to assume control of it and we broke it off on them. Well, we stopped it, that is all. The law does not say that the county commissioners have anything in the world to do with it at all. It is under the control of the governor of the State and the board of commissioners, and it says in regard to the Monument reservoir—I have looked it up—that the water shall be sold to the highest bidder.

Q. I read from section 2495–C, 1–1/8, of Mills' Annotated statutes, third volume:

"The board of county commissioners shall have charge and control of that certain State reservoir situated in said county and commonly known as the Boss Lake reservoir, and shall, without expense to the State of Colorado, maintain and keep said reservoir in good condition."

A. Well, that is not the case with the Monument reservoir. This reservoir specified or designated as the Boss Lake reservoir is the one I have been testifying of, in Chaffee county, but I know that is not the case with the Monument reservoir.

1616 Q. Don't you know that the board of county commissioners of the county has control of the Monument reservoir?

A. No, sir, I do not. I know they tried to control it, and I know that—it doesn't say so in the statutes at all.

Recross-examination.

By Mr. CAMPBELL:

I stated in answer to a question put to me by you (Mr. Campbell) that there were flood waters sufficient to irrigate a hundred thousand acres of land which now escape; that is, they could irrigate a hundred thousand acres of land if they were properly impounded and stored in reservoirs; and in answer to Mr. Loomis' question I said that there were certain reservoirs here that had never been filled. In explanation of these two statements I will say that when the ditches that carried the water to these reservoirs that were never full were given permission to take reservoir water they broke and it took them all the time to repair it and the flood water was gone before it was repaired. I didn't mean to say that there was not sufficient flood water to fill those reservoirs already constructed; I

meant they couldn't take it and didn't take it because the
1617 ditches were out of repair when they did have it. But it was not by reason of lack of flood waters. I don't think any of these reservoirs I have testified about are located upon the public land.

DENVER, COLORADO, September 2, 1904.

1618 LOUIS G. CARPENTER, Denver, Colorado.

Direct examination.

By Mr. SMITH:

I am State engineer of Colorado. I am appointed by the governor of the State. I have held that position since April, 1903.
1619 As State engineer I have custody of such records relating to irrigation in Colorado, ditches, and measurements of streams as are taken by those connected with the administration. The State gives the State engineer general authority and also certain general duties. As State engineer I require certain reports from time to time from my subordinates. The subor-inates, the water commissioners and the division engineers have certain statutory authority. I have general supervisory authority over the division engineers
1620 and water commissioners. The State is divided into five divisions. The divisions are divided into districts. There are some districts that have no water commissioner appointed in them. The authority of each water commissioner is limited to a certain district. Certain of these districts united constitute one division and are under the superintendence of a division engineer. An appeal lies from the decision of the division engineer to the State engineer. Division No. 2 constitutes the Arkansas river and its tributaries. District No. 14, division No. 2, is a part of the Arkansas river. The paper just handed me is a portion of the report of the water commissioner of district No. 14, division No. 2, for 1895. It is a part of the records of my office. (A copy of this report is introduced in evidence as Complainant's Exhibit A–15.)
1621 The paper you now hand me is the corresponding report of district No. 14, division No. 2, for the year 1896, and is also a part of the records of my office. (A copy of this report is introduced in evidence as Complainant's Exhibit A–16.)
1622 The five papers now handed me are similar reports of district No. 14, division No. 2, for the years 1897, 1898, 1899, 1900, and 1901, and are official records of my office. These are the five reports of the water commissioners for this district. (Copies of these reports are introduced in evidence as Complainant's Exhibits A–17, A–18, A–19, A–20 and A–21.)
1523 The six papers now handed me include part of the report of the water commissioner of district No. 17, division No. 2, for the years 1895, 1897, 1898, 1899 and 1900, and one is presumed to be for 1896, but I cannot positively identify it. These are similar

reports to those referred to above and are kept in my office under the same circumstances. (Copies of these reports are introduced in evidence as Complainant's Exhibit- A–22, A–23, A–24, A–25, A–26 and A–27.)

The seven papers now handed me include portions of the annual reports of the water commissioners for district No. 67, division No. 2, for the years 1895 to 1901, inclusive. They are similar records to the ones referred to above and are kept in my office under the same circumstances. (Copies of these reports are offered in evidence as Complainant's Exhibits A–28, A–29, A–30, A–31, A–32, A–33 and A–34.)

1524 The reports which have been offered here are the latest that I have in which they have been averaged and compiled in this manner by the water commissioners. Field books were sent to the water commissioners during the last two or three years for daily records, and those field books have been compiled but apparently the compilation has not been made by the water commissioners.

1525 We have some incomplete records of the stream measurements, of a number of tributaries of the Arkansas river, these records not being made, however, by this office. They are on file in this office.

The paper you now hand me is a copy of the data which we have of the flow of the Purgatoire river for the years 1900, 1901, 1902 and 1903. This copy was prepared in my office. (This copy is introduced in evidence as Complainant's Exhibit A–35.)

The first of the three papers now handed me is a corresponding copy of the data obtained in a similar manner from private sources on the Tempe creek from 1900 to 1903, inclusive; the second is of the Apishipa, from 1900 to 1903, inclusive; the third is from

1526 the Fountain, for the years 1901, 1902 and 1903. These copies were prepared in my office. (These copies are introduced in evidence as Complainant's Exhibit- A–36, A–37 and A–38.)

These four streams just mentioned are all tributaries of the Arkansas river in Colorado. We have no regular source of measurements of other tributaries of the Arkansas river below Cañon City. I think we have some of the Huerfano, and all the other measurements are just occasional ones, not regular, and are not similar records to those just introduced. They are imperfect, and these are imperfect, a great many days lacking. There are a great many dry streams that run water as a rule only in times of heavy rain, which are also tributaries of the Arkansas river in Colorado. Those that have a regular flow the year round are: Beaver creek, Oil creek or Four-mile creek, St. Charles creek has a small amount, usually from seepage, and the others are mostly seepage

1627 streams—purely flood streams. These are not tributaries except in time of flood. The flow is very small. After heavy storms we learn of tributaries that we never knew of before. These four streams that we have been talking about and the mea-

urements of which were introduced in evidence are not tributaries except in times of flood. They do not ordinarily bring down much water except in flood periods. Most of the water of these streams is either taken out or sinks before it reaches the Arkansas river. Practically whatever water they deliver to the Arkansas river, then, except in times of flood, is seepage or return water.

We have some records in this office of the seepage measurements of the Arkansas river; that is, of the return water from irrigation to the Arkansas river. The State engineer's office has never taken these measurements, but I think we have some records here of some years. They were made by the experiment station or the
1628 irrigation engineer at Fort Collins. They include the summation for several years. Some of them were printed in this report. These measurements were made by me or under my direction, but not as State engineer, in fact not in connection with the experiment station. The experiment station is the agricultural experiment station. It is the organization supported by the United States Government for the purpose of experimenting on matters that affect the agriculture of the State. There is one in each State. It has no connection with the State engineer's office whatever. It simply furnishes this office as a matter of courtesy—a friendly exchange of data.

1629 Complainant offers in evidence section 616, on page 264, of volume 3, Mills' Annotated Statutes (revised supplement), Colorado, with the heading "May condemn right of way," and we ask that it be cited in full in the record.

Said section reads as follows:

"If any corporation formed for the purpose of constructing a road, ditch, reservoir, pipe line, bridge, ferry, tunnel, telegraph line or railroad line, shall be unable to agree with the owner for the purchase of any real estate or right of way or easement or other right necessary or required for the purpose of any such corporation, for transacting its business, or for the right of way or any lawful purpose connected with the operations of the company, such corporation may acquire title to such real estate or right of way, or easement or other right, in the manner provided by law for the condemnation of real estate, or right of way, and any ditch, reservoir or pipe line company may in the same manner condemn and acquire the right to take and use any water not previously appropriated."

Complainant offers in evidence also section 2495 W. of the same volume, entitled "Reservoir in Chaffee county—appropriation."

Also section 2495 Y., of the same volume, entitled "Board of construction—powers—cost."

Also section 2495 C 1, of the same volume, entitled "State own reservoir."

Also section 2495 O 1, of the same volume, entitled "Reservoir at Monument creek—appropriation."

1631 JAMES COWIE, Denver, Colorado.

Direct examination.

By Mr. ASHBAUGH:

I am secretary of state of the State of Colorado. As such secretary of state I have in my office the original charters of all irrigation companies filed. I am the keeper of the great seal of the State of Colorado. I have the original charters of certain ditch companies before me now. These charters show filing as follows:

The charter of the Bessemer Irrigating Ditch Company was filed on the 23rd day of May, 1888.

The charter of the Twin Lakes Land and Water Company was filed on the first day of June, 1898.

The charter of the Rocky Ford Canal, Reservoir, Land, Loan and Trust Company was filed on the 7th day of December, 1889.

1632 The charter of the Oxford Farmers' Ditch Company was filed on the 12th day of October, 1888.

The charter of the Otero Canal Company was filed on the 8th day of March, 1890.

The charter of the Catlin Consolidated Canal Company, being a consolidation of the Catlin Canal and Land Company and the Fairmount Lateral Ditch and Reservoir Company, was filed for record on the 17th day of November, 1892.

The charter of the Laguna Canal Company was filed for record on the 4th day of July, 1892.

The charter of the Rocky Ford Ditch Company was filed for record July 27th, 1882.

The charter of the Fort Lyon Canal Company was filed for record on the 10th day of July, 1887.

The charter of the Arkansas Valley Sugar Beet and Irrigated Land Company was filed for record on the 22nd day of April, 1901.

1632 The charter of the Lamar Canal Company was filed for record on the 8th day of February, 1893.

The charter of the Graham Ditch Company was filed for record on the 17th day of September, 1889.

The charter of the Colorado Fuel and Iron Company was filed for record on October 21, 1892.

1634 Cross-examination.

By Mr. BEAMAN:

It is true that the corporation known as the Colorado Fuel and Iron Company is a consolidation of other corporations which were organized long prior to the date of the incorporation of that company, but I don't remember the dates and names of the prior corporations which were merged in the consolidation, without making a search.

Cross-examination.

By Mr. ROGERS:

The certificate of incorporation of the Arkansas Valley Sugar Beet and Irrigated Land Company is a certificate of a corporation created under the laws of the State of New Jersey.

Cross-examination continued.

By Mr. DAWSON:

I think it is true that many of the articles of incorporation which I have just been asked about have been amended since the respective dates of filing given by me.

GARDEN CITY, KANSAS, September 19–21, 1904.

1637 O. C. EMERY, Garden City, Kansas.

Direct examination.

By Mr. ASHBAUGH:

I live in Wichita, Kansas, and am a newspaper reporter. I am acquainted with the Arkansas river at Wichita, Kansas, and the Douglas Avenue bridge across the river in the city of Wichita. I am acquainted with Complainant's Exhibit A–41. It is a photograph of the Douglas Avenue bridge across the river at Wichita, taken on the 16th day of September, 1904, from the east side of the river and the south side of the bridge. (Exhibit A–41 offered
1638 in evidence.) It is a correct picture of the bridge and the Arkansas river as they were on that date. The bank that shows in the middle of the picture at the left of the bridge is an island, and there are some cottonwood bushes shown upon it. It is about two-thirds of the way across the Arkansas river from the east side. The channel of the river east of the island is at least two or three times the width of the channel on the west side of the island. The piles that show under the first abutment are the original piles upon which the stone abutment was built when the bridge was put in. At the time this picture was taken it was two feet from
1639 the water to the stone and the piling protruded above the water about a foot. There is a wooden structure or base for the stone pier about a foot thick on the top of the piles, making about two feet all together. The wooden structure or grillage I spoke of is laid lengthwise across the piling, up and down the river. This is eight inches thick, and then on top of that are four-inch oak planks, crosswise. This wooden grillage work is about one foot below the stone structure. When the wooden work, constructed as that is, shows above the surface of the water, the alternate wetting and drying of the wood would necessarily shorten the life of it; it couldn't last for a great length of time. The alternate wetting and

drying would cause it to rot more rapidly than if it was constantly wet or constantly dry. The piling and the grillage show in the second abutment in the same way as in the first one. The cost of this bridge when originally constructed was about thirty-eight thousand dollars.

1640 I have been in Colorado and have seen most of the ditches and the head-gates along the Arkansas river up as far as Pueblo I saw them during the month of August, 1904. Beginning at Lamar, Colorado, I visited nearly all the dams and head-gates and ditches from that point to Boone along the Arkansas river. I visited the Amity dam first; it is located about nine miles up the Arkansas river from Lamar. The dam is constructed principally of timbers, with some cement work. I was unable to ascertain at the time I was there the dimensions of the timbers because at that time the water was flowing over the dam from side to side, with the exception of a portion near the center of the river, under which

1641 the water was flowing, which had been forced up through the water by the flood. As near as I could ascertain, the dam was built by driving piling into the bed of the stream, and spiking timbers onto that and building as most dams along the river have been built. From what I could ascertain, the Amity dam is the most expensive dam and the most elaborate one on the river that I saw between Lamar and Pueblo. To the best of my judgment the Amity dam is about 500 feet long and extends from bank to bank of the river. I was unable to measure the height of the dam,

1642 but as near as I could guess at it it must be about eight feet high. It is as high as the top of the adjacent bank on the south side. The cement sections that I spoke of were evidently built in there for the purpose of allowing surplus water to flow through, because they appeared to be a little lower than the main body of the dam and were evidently built for the purpose of allowing the water to flow over them rather than over the wooden structure. Whether any of the ordinary flow of the river would go over or around or through the dam would depend, I judge, upon the condition of the head-gate at the ditch. At the time of the ordinary flow in the river, if the head-gate of the ditch was open, my opinion is that the water would flow into the ditch rather than over the dam. At the ordinary flow of the river I think that none of the water would go over the dam if the head-gate of the ditch was open. It was certainly constructed for the purpose of taking the whole of the river.

The next dam I visited above the Amity dam was about three miles above the Amity, the Maxwell ditch, on the south side of the Arkansas river. There are two ditches that leave the river

1643 at that point—one a short ditch, a private farmer's ditch, called the Kessee, and the other is the Maxwell ditch, which is about thirty-five miles in length. Both are on the south side of the river. One dam serves for both of these ditches. It was a wooden dam about four feet high, extending from bank to bank of

the river. The effect of the dam was to back the water up and force it into the mouth of a small stream on the south side of the Arkansas river called Mud creek, and the head-gates open out of this stream a few rods from the river. This dam was so constructed that none of the water could pass over or around or through the dam at the ordinary flow of the stream, and it is my judgment that in the ordinary stage of the river if both head-gates were open no water would pass over the dam.

The next dam I examined is the Fort Lyon dam, located
1644 three miles above La Junta, on the Arkansas river. The dam is built very much as the others that I have described. It extends from bank to bank and is really one of the best dams I visited. It probably didn't cost as much as the Amity, but it is a very substantial structure and certainly does the business for which it was constructed. Examining Complainant's Exhibit A–42, I recognize it as a correct picture of the Fort Lyon dam, taken on the 24th day of August, 1904, by a photographer at La Junta by the name of Moyemont. (Exhibit A–42 offered in evidence.) The Fort Lyon dam is constructed by driving piling into the bed of the stream and spiking timbers across the piling from one side of the
1645 river to the other. Above, the timbers are given a slant up stream, making a very substantial wooden dam. It extends from bank to bank, and is about ten feet on the lower side of the dam from the bed of the river to the top. There was no means for any water at an ordinary flow of the stream passing over, or around or through the dam when the head-gates of the ditch were open. That wooden work shown in the picture just below the dam is a sort of apron upon which the water is supposed to flow when it runs over the dam. I couldn't say when the water runs over the dam, only except in extreme high water or in an unusual stage of the river. There was at the time I visited it certainly an unusual flow of the river, but none that was flowing over the dam. I think that water might and perhaps would have to flow over the dam when the head-gates of the Fort Lyon canal were closed. I would say that water would flow over the dam at the ordinary stage
1646 of the river when the head-gates were closed, because in time it would necessarily have to pile up and back up sufficiently to force itself over the dam, (objection), but this would not be true if the head-gates were open, because the ditch is certainly considerably lower than the bed of the stream of the river. In that case the water would flow into the ditch rather than over the dam. The head-gate of the ditch is wide enough to receive all the ordinary flow of the river on the day I visited it. On the day I visited it all the water that flowed in the river flowed into the ditch. At that time, as to any flowing water down the river below the dam, there was only a very small portion that managed to seep under the dam. None of it flowed over at all. Examining Exhibit A–43, I recognize it as a correct picture of the Fort Lyon head-gate and the wooden riprap or protection that is built

just a few rods up the river from it. This picture was taken by the same party, on the same day and upon the same occasion as the other—the 24th day of August, 1904. (Exhibit A–43 offered
1647 in evidence.) This picture shows the water in the Arkansas river above the Fort Lyon dam, above the head-gate of the Fort Lyon ditch, showing that all of the water of the river is running through the head-gate into the ditch. The dam is shown at the right side of the picture. Near the center of the land area is seen a straight horizontal line there which marks the top of the dam, although it does not show very distinctly. That black line running across the picture is a shadowy outline of a sand bar that shuts off the water of the river from flowing over the dam. That sand bar was about eighteen inches high above the surface of the water in the river. The wood work that shows at the left side of the picture in the foreground is a sort of protection that has been built in there by driving piling and the spiking of timbers across to catch the drift wood and other substances that might pile up against
1648 the head-gate and drift into the ditch and cause trouble. Just above the wooden structure shown in Exhibit A–42, the water was on that day about four feet deep. By noticing very closely near the right end of that wooden work a man can be seen standing in the water, the water reaching almost up to his arm pits. The smooth surface in the body of the picture is water. Examining Exhibit A–44, I recognize it as another view of the Fort Lyon head-gate and dam, taken from a slight eminence just above the head-gate on the north side of the river, taken by the same person, at the same time and on the same occasion as the other two—
1649 on August 24th, 1904. It shows in detail the lower side of the head-gate from which is issuing the water shown in Exhibit A–43, which flows through it from above, and on the left side of the picture are the outlines of the dam, extending from bank to bank. (Exhibit A–44 offered in evidence.) The Fort Lyon head-gate is about 66 feet wide, and on the day I was there the water was flowing through it about four feet deep. The Fort Lyon dam and the head-gate are permanent structures, costly and expensive.

The next dam that I visited was the Rocky Ford dam,
1650 about three and a half miles below Manzanola. The Rocky Ford dam on the day I saw it was considerably demoralized because there had been so much water in the river that it had been partially torn out, and men were working on it trying to hold back the water as much as they could with sand bags and brush and every other device. The dam itself I think is about six feet high and extends from bank to bank. There is no waste-way or sluice gate for any water to pass off, around or through the dam. The head-gate of the dam is located near the southern end of the dam, on the south side of the river. I should say that the Rocky Ford dam was constructed for the purpose of taking the ordinary flow of the river and forcing it into the canal and that it would do that if the dam was in good repair.

I found waste-ways or sluice gates constructed in some of the canals that I saw, and they were usually a short distance below
1651 the head-gates. In that country they are called sand gates. They are called sand gates because they open from below and permit a flood of water to pass out whenever it is necessary to clear out sediment and sand and debris that settles in the ditch, (objection), otherwise the ditch would fill up from the sand that washes into it from the river. I visited only three of these sand
1652 gates, one at the Fort Lyon ditch, one at the Otero ditch and one at the Bob Creek ditch. The sand gate at the Fort Lyon ditch is simply an opening with a gate through which the water might pass from the ditch back into the river or toward the river. This sand gate was about a quarter of a mile below the dam. There was no water flowing through it on the day I visited it, or but very little, that forced its way through and under. None to speak of. It was not open for that purpose.

The next head-gate that I visited was the Laguna head-gate, located two miles below Manzanola, on the north side of the Arkansas river. At the time I visited it there was no dam, although there has been at some time sufficient to back up and hold back the sand wash of the river to a considerable extent. The head-gate of the Laguna ditch is constructed in a bend of the river at a point where the current of the stream sets toward the northern bank and
1653 the water flows readily into the ditch, which is lower than the bed of the stream. It is not necessary, therefore, at an ordinary stage of the river, to have any dam at that point. From the natural construction of the river and the construction of the canal the water at ordinary stages of the river would go into the canal without any artificial dam.

The next dam I visited was the Otero dam, about a mile above Fowler. It is a wooden dam, built from bank to bank of the river, about six feet high. Except when the water in the river is high enough to rise above and flow over the dam, the construction of this dam is of such a nature that it would divert all the water into the ditch.

The next dam I visited was the Catlin dam, four and a half miles below Fowler on the Arkansas river. It is constructed very much as the Otero dam. It is a wooden dam extending from bank to bank of the river and about six feet high.

1654 These measurements of the height of the dams that I have given are from the bed of the stream below the dam. The Otero and the Catlin dams are both built just below the mouths of small creeks which put into the river from the south side, and the water is forced up into these creeks a few rods and the head-gates open out of the creeks. The effect of this dam is the same as that of the Catlin, that is, to take the whole of the ordinary flow of the river and force it into the canal.

The next dam I visited is at the Oxford Farmers' ditch, a mile and a half above Nepesta. It is a wooden dam, built very much as

the last two—the Otero and the Catlin. It is from bank to bank and from four to six feet high. The effect of this dam must be to divert the whole water of the river at the ordinary flow into the ditch.

1655 The next dam I visited is the Rocky Ford Highline, which is about six miles up the river from Nepesta. It is constructed very much as the others, a substantial wooden dam about six feet high and from bank to bank, and at the ordinary stage of the river, in my best judgment, all the water would be diverted into the ditch if the head gates were open.

The next dam I visited is about two miles above Boone. It is a small brush dam, called the Arkansas Valley dam. It is quite a frail affair, and frequently washes out, I learn. The Arkansas Valley ditch is only about eight miles long and does not require very much water. It is one of the oldest ditches and usually gets a pretty good supply because of the priority of its claim. On the occasion of my visit there was a sufficient dam there to force the water into the canal.

1656 The next dam I visited is the dam of the Colorado Land Company, called the Bob Creek, three and a half miles above Boone. It is one of the most substantial dams that I saw, although it is not the highest. It is well constructed and built by driving piling into the river and spiking timbers to it. It is permanent and extends from bank to bank and is at least six feet high. The effect of this dam would be, at the ordinary stage of the river, if the headgate of the ditch were open, to divert the water from the river into the ditch. Upon the occasion of my visit, however, the head-gates were not open and there was no water in the ditch. It was so constructed as to allow the whole of the ordinary flow of the river to pass into the ditch. (Objection). There was a sand gate constructed in this ditch about a mile below the headgate, but as the ditch was dry the sand gate was closed. This was the last
1657 dam I visited. All these visits were made in the month of August, 1904.

Cross-examination.

By Mr. DAWSON:

I went up the river partly for the purposes of examining these ditches and their dams and head-gates. I didn't examine the headgate and dam of the Garden City ditch, the Farmers ditch, the Amazon ditch, the Great Eastern ditch, or any ditches in Kansas.

I was possibly discriminating against the Kansas ditches
1658 partly because I was interested in the Colorado ditches.

I live in Wichita, Kansas, and am a newspaper reporter. I have lived in Wichita a little over two years and in Kansas since 1872. About three years of that time I have lived on the Arkansas river. I am not interested in any lands lying in the valley of the Arkansas river at this time, nor directly interested in farming,

either by or without irrigation, in the Arkansas valley. My interest in these Colorado ditches did not grow out of any personal holdings of mine, but I was simply employed to make this investigation and look it up. During the progress of this trial I have been in attendance at practically all of the hearings as reporter and representative of the Daily Beacon of Wichita. We have tried in the paper at all times to give the evidence as it has been
1659 brought out fairly on both sides as matter of news, but as a matter of policy and the paper's standpoint on the proposition, it very naturally advocates the Kansas side of the proposition. I never was on the river in Colorado below Pueblo until this last trip in August that I have spoken of, so that my knowledge of this particular country that I have been describing is simply the knowledge gained during this visit in August, 1904. I have been through Pueblo four or five different times prior to August, 1904—just passed through. I have never lived on the Arkansas river anywhere in Colorado. I had no reason to observe it or any particular knowledge of the river in Colorado until I made this special trip last August, nor had I lived on the river in western Kansas anywhere.

As to the information from which I made the statement in my direct examination as to the ordinary flow of the river, I will
1660 say that my best judgment is founded on observation of the river as I found it upon the occasion of my visit, which led me to believe that it was above the ordinary stage, decidedly. I talked with people from Lamar to Pueblo, and invariably the statement was made that this is an unusually wet season in Colorado, that the rains have been unusually heavy, and at least four times during my visit in Colorado it rained. And so I was led to think, and I believe it was a reasonable conclusion, that the river was higher than the ordinary stage. As a matter of fact, I wouldn't say from what I saw as to rainy conditions in Colorado that Colorado was a rainy country, but from the same general observations I think the river was above the ordinary stage. I couldn't put in cubic feet per second of time what I consider to be the ordinary flow of the Arkansas river at any point. I don't know how much water it takes, looking at it running in the stream, to make any given
1661 amount of cubic feet. I haven't had any experience whatever in measuring water nor in the construction and operation of ditches, and I am not an expert on the subject of ditch or dam construction for the diversion of water or as to the amount of water that flows in a given stream. I have no personal knowledge as to whether or not any given amount of water that I saw flowing in the Arkansas river in August in Colorado was the ordinary flow, taking it one month with another, nor as to whether it was the ordinary flow taking it one year with another.

I don't know the carrying capacity of any of these ditches in cubic feet per second of time that I have referred to. When I said that the Rocky Ford dam was about six feet high and was made so that in ordinary times it would take all the ordinary flow of the river, I

said "to the best of my judgment," because at the time I visited the Rocky Ford dam it was partially torn out. I don't know that the carrying capacity of the Rocky Ford ditch is not to exceed 150 cubic feet of water per second of time, but I do know that I saw the Arkansas river at three different points between Lamar and Pueblo where there was not that much water in the river. This dam certainly stores the water in that it backs it up the stream and diverts it into the ditch. It is true in the instance of the Fort Lyon dam that the only result of that dam upon the natural flow of the river is that back of the dam the level of the bed of the river has been raised to a level with the dam, so that if the head-gate was shut down
I believe the water would flow on its course over the dam
1662 just as readily as if the dam had never been constructed. If it is not true now that each of these dams that are constructed across from bank to bank have resulted in the sand filling in back of the dam so that it simply lessens the fall of the river slightly and raises the bed of the river so that it brings it on a level with the head-gate or ditch, so that when it is raised it will allow water to go in, that will eventually certainly be the result, because the drifting sand will naturally pile up against the dam. That is the very purpose for which they raise it, to make the level of the river higher. I will say that I didn't see any of these dams that were evidently constructed for the purpose or that served the purpose of storing the water in themselves, and yet were it not for the fact that the sand and sediment and drift in the river washes in and fills up against the dam it would have that effect. But it does wash in and fill up. Even if it is stored, the water when the dam was first built before the sand was washed in would be a very small amount, that is from four to about ten feet, I guess, at the highest dam. The Fort Lyon dam is about ten feet high, approximately. I think I placed the Amity dam at about eight feet. I had to estimate that. I didn't measure it.

1664 The picture of the Fort Lyon dam, Complainant's Exhibit A–42, is taken from the lower side of the dam. It is not true that a man of my height can stand below the dam and see over the top of it. I stood there myself and tried to look over the top of it. That dam, from the apron to the top of the dam, is fully seven feet in height, and it must be from there to the bed of the river very nearly three feet more. As to whether the water in going over this apron has dug out the sand and really made it lower than the bed of the river naturally would be, and that the apron itself is practically on the bed of the river, the picture here shows for itself. The lower part of the apron is covered with sand. There is no considerable or noticeable wash below the dam.

I believe my statement was that the Rocky Ford Highline was
another one of those dams that I thought were so constructed
1665 as to divert all the ordinary flow of the river. As to whether the carrying capacity of that ditch does not exceed three hundred feet, that it is something between two and three hundred feet,

I know nothing about the carrying capacity of any of the ditches. I don't know that even the Bob Creek ditch has a carrying capacity of not to exeeed five hundred cubic feet per second. The ordinary flow of the river that I speak of means to me the flow of the river during that period of the year when there is no unusual flow of water caused either by heavy rains or the rapidly melting snows, but that period of the year in which just the ordinary flow of water would naturally be found in the river. I do not necessarily mean by that the minimum flow at the dryest time or the maximum flow; I mean the ordinary, average flow.

If it should be true as alleged in the bill of complaint here that the ordinary flow of the river is as much as two thousand feet, or even seven hundred as alleged in another part of it—cubic feet per second of time—I am inclined to think that none of the
1666 ditches that I have referred to as being constructed to carry all of the water would carry it. Upon the day that I visited the Fort Lyon dam I was informed by the head-gate keeper that they were taking something over seven hundred feet of water that day. I will say the same thing for the Amity ditch—that they were taking over seven hundred feet of water in the Amity ditch the day I visited it, according to the statement of the head-gate keeper. It is true that if seven hundred cubic feet per second of time constitute the ordinary flow of the river, there are several ditches I have mentioned as being so constructed as to take all of the ordinary flow that would not carry that amount.

1667 I visited the Amity ditch and dam and head-gate on Tuesday the 23rd of August, 1904. I visited the Fort Lyon dam on the 24th of August. I visited two or three ditches in a day, some of them. I visited the Maxwell and Kessee ditch on the 23rd of August. At Manzanola on the 25th I visited the Laguna or Holbrook ditch, and the Rocky Ford ditch, and then I went to Fowler the same day and visited the Otero and Catlin ditches, on August 25th. On the 26th, from Nepesta, I visited the Oxford Farmers ditch and the Rocky Ford Highline, and on August 27th I visited the Arkansas Valley ditch, that is, the small ditch, and the Bob creek. So I put in the time from August 23rd to August 27th. When I visited the Amity ditch it was running water, and that was the lowest ditch down that I visited. On the same day I visited the Maxwell ditch and that was running water. The Maxwell ditch therefore was not taking all of the water on that day. Next day I visited the Fort Lyon ditch and it was taking all of the water at that time. I don't know how the Amity ditch was getting
1668 its water that day, and I don't know whether it was getting it, because I didn't visit it on the 24th, so that I don't know personally whether the Amity was getting water on the same day the Fort Lyon was or not. I took particular pains to see whether the Fort Lyon ditch was on that day allowing water to go out through its waste gate or sand gate back into the river, and there was not a drop of water that didn't seep through it or force its way

through the closed gate. That was on the 24th of August. But I didn't go back down that day to see whether the Amity was still getting water. I have no theory to account for the fact that the ditches lower down were getting water the same time that
1669 the ditches above were taking it all. As far as I saw those ditches, the Bob Creek ditch was getting no water. That was the only dry ditch I saw, and it was the highest up the stream. There was water going by it at that time. As soon as its head-gate was shut down the water moved down the river without any hindrance as soon as it rises high enough to pass over the dam.

My first experience with sand gates was when I went up here to see those ditches. I had no particular experience with them then. Every one that I have heard mention them at any place called them sand gates. Whether they be called sand gates or waste gates, they serve the purpose, according to my understanding of letting the water go out of the ditch back into the river, though I didn't follow them to the river. It would let it leave the ditch, but there were none of them large enough, that is, as large as the head-gates or as wide as the head-gates, so that it might empty the entire
1670 volume of water out of the ditch. Most of the large head-gates are only partially opened. They are arranged so that they can open them to take in a small or moderate or large amount of water. It might be that the head-gate was so constructed as to catch a very large amount of water at flood time when the canal or ditch itself in ordinary times would not be entitled to all that head-gate would take through it. As to whether a ditch's right to take water, or the water that it actually takes is governed by the size of its head-gate, I am not very familiar with the irrigation laws and customs of Colorodo in that particular. The only two ditches I saw where the head-gates were open were the Amity and the Fort Lyon ditches and the others were only partially open, so as to take only a small amount what they could actually take. As to whether the Amity canal has a priority that is older and goes ahead of a certain priority which the Fort Lyon canal has, I know nothing about it, and as to whether, even when there was not enough water in the river to supply the Fort Lyon in full, it would be bound to let some of that water go down to the Amity, I know nothing about that. I know they were not doing it on the occasion of my visit. There was no water going over the dam down the river at that time. The water which the Amity was getting down below must have come from some where besides going over the dam. I have heard quite a good deal about return waters from irrigation while I was out in Colorado. I couldn't say whether I saw any of that at the Amity
1671 or not. It must have come from somewhere. As I went up the river through Kansas I didn't notice whether there was any water in the river between here and the State line. I went in the night, so I don't know whether the water was running here on the 21st or 22nd, whenever I went up. The first point at which I saw the river after we left somewhere in the neighborhood of Ster-

ling, so that I could tell anything about whether there was any water in it, was at Lamar on the morning of the 23rd. There was some water in the river there at that time. That is below the Amity and Fort Lyon dams and below all of those that I saw, and there was some water flowing in the river there. When I saw the Amity there was water running over its dam and it was not taking all the water that could be had at its head-gate. There was a considerable volume of water passing over the Amity dam on the day I saw it,
1673 enough so that I couldn't measure the dam with any accuracy at all. I wouldn't say that the water would average over possibly four inches in depth the entire width of the dam; that is, I suppose, approximately, five hundred feet wide. I believe they told us that that was the width of the dam. That is the lowest dam in the river in Colorado that I saw. I don't know whether it is the lowest one down or not.

Referring to Complainant's Exhibit A–43, showing the dam and head-gate of the Fort Lyon canal, I couldn't say how deep the smooth surface shown in the picture as water is above the dam, but by looking at the picture, near the right side of the riprap you can see a man standing in the water nearly up to his arm pits. The water at that point is about four feet deep. I don't think it is any narrower where it gets to where that man is than it is from the point at which the photograph was taken, a hundred yards above. I don't know whether he is standing in a hole or not. I asked him to wade out there that I might see how deep the water was.
1674 Complainant's Exhibits A–43 and A–44 were taken to show the same depth and head-gate and taken on the same day and practically at the same time, and however deep or wide the water may be in Complainant's Exhibit A–43, that same water is all running in the Fort Lyon canal as shown in Exhibit A–44.

The picture marked Complainant's Exhibit A–41, showing the bridge at Douglas avenue, in Wichita, Kansas, was taken on September 16 of this year and shows that water does not come up to the stone as laid in the abutment.

I heard the evidence given in this cause at Wichita, and the testimony that early in the summer there had been a great flood
1675 in the Arkansas river at that point, and I also heard the witnesses testify that it had been the habit for a long time to dig out and haul away sand from the bed of the river just below this Douglas Avenue bridge, and I know they have taken some sand from the river since that time, but not so much as they had before, because of an unusual flow of water in the river. The dredge is still working there taking out sand part of the time, but it must be a quarter of a mile below the bridge.

It is possible that the natural tendency of narrowing the channel of the river, dredging the sand out below the bridge, and of this large flood coming down there, would be to lower the bed of
1676 the river or dig out the sand so that in an ordinary flow the water would be at a lower level and expose more of the piling

than it would if those things had not been done. I can't say as this would be the probable result. Where the channel is narrowed up the tendency would be to scour out the river bed, and I understand this is the way adopted by engineers, among other ways, both in harbor construction and the cleaning out of rivers, to deepen the channel. As to whether these piles were driven to a level with the sand or bed of the river at the time the bridge was constructed, the custom in all such cases is to drive the piles as deep as the water level in order even at the lowest stage of the water the wooden
1677 structure may be always below water. I think it is true that the fact that the piles are now exposed indicates that by some process the river has scoured out so that the sand or bed of the river is lower than it was when the bridge was built. The surface of the water also must necessarily be lower.

My object in going to Colorado was not primarily to ascertain what Colorado was doing, but partially so, but to ascertain the conditions of the river in Colorado was the object of my visit. I think it may be said I went for the purpose of trying to find out
1678 what was the cause of the diminished flow on the lower reaches of the river.

Q. Well, if that is true why is it that you went directly by these ditches in Kansas that are to-day running water and made no investigation of them and limited your investigation to Colorado?

A. Because the contention is between Kansas and Colorado in this matter.

Q. But if your purpose was to investigate the true cause of the diminished flow in Wichita and on the lower reaches of the river, would not the circumstance of a ditch taking water in western Kansas be just as important as the circumstance of a ditch taking it in eastern Colorado?

A. I think it might affect it to some extent in the same way.

In reference to their being any difference in the soil in western Kansas and eastern Colorado, I would say the demarcation is so fine that I would hardly be able to state that I had found a difference. It shades off. I think that expression would cover it. I think I can say truthfully that there is a decided difference between
1679 the soil at Lamar and the soil at Garden City and farther east along the Arkansas river. I don't think the soil here at Garden City is practically identical with that up about Rocky Ford. This is a decidedly looser soil; that is, it is more sandy. There is not so much adobe or decomposed shale mixed with it. I think this soil would absorb more water.

Cross-examination.

By Mr. CAMPBELL:

Of my own knowledge I don't know that there are ditches in Kansas taking water from the Arkansas river for irrigation
1680 purposes. I have made no personal investigation.

Redirect examination.

By Mr. ASHBAUGH:

In reference to my statements about sand being scooped out of the bed of the river below the bridge at Wichita, I will state that the scooping out of that sand has not made any rapids in the river. I think the surface of the river flows as it always has and just as it used to whether the sand is scooped out or not. (Objection.)

1681 It is the custom in building bridges of the kind of the Douglas Avenue bridge to put the piles down and cut them off below the surface of the water, and I understand these were put down in that same way.

I lived in the Arkansas valley in the summer of 1876.

The character of the soil as I saw it this summer from Lamar to Pueblo varies, or rather gradually shades from a soil mixed with gravel and decomposed shale at Lamar to Pueblo, at which point the quantity of shale is greater than at Lamar. As you near the mountains or foot hills the adobe soil or decomposed shale is more pronounced. This adobe soil is a soil that is very fine when

1682 it is pulverized, as fine as ashes, and in places and under most conditions is very compact. I should say that I didn't find any places in the valley of the Arkansas river from Lamar to Pueblo where the soil in its natural state was saturated with water so that vegetation would grow upon it. I found cactus and greese root and sage brush and Russian thistles very plentifully where it had not been cultivated. At most places this condition extends down to the banks of the river in its natural state. I saw nothing of the kind from Lamar to Pueblo that corresponds with what is known as the first and second bottoms along the Arkansas river in Kansas.

Recross-examination.

By Mr. DAWSON:

In speaking of the cactuses, weeds and sage brush from Lamar to Pueblo along the river I had reference to that part of it which

1683 was not under irrigation. That part which is under irrigation appears to be very productive.

I lived at Sterling in 1876. Sterling is about thirty miles up the river from Hutchinson. The dry season of that year was in July and the flow in the river at that place and in that month was sufficient to cover the river bed almost from bank to bank. There were a few places where there were small sand bars. The water was from four to five feet in places to a few inches in depth. That was the only year I had any knowledge of the river at that point.

1684 I was little more than a boy at the time, and we frequently went down there to swim that year. They always spoke of the river as being about half a mile wide. In speaking of the cactuses and sage brush extending down to the river in Colorado I was speaking of the natural state of the land before it was irrigated.

F. L. PIERCE, Garden City, Kansas.

Direct examination.

By Mr. SMITH:

1685 I live at Lakin, Kearney county, Kansas, and have lived there ever since April, 1879. I am fifty-seven years of age. Lakin is twenty-three miles west of Garden City. My occupation has been stock raising, farming and laborer. I live at the present time and for a great many years have lived within half a mile of the river, the house being in sight of the river. My pasture borders on the river, and in attending to my stock I am obliged to
1686 see the river almost daily. As to the average flow of the river at Lakin for the last four or five years as compared with what it was when I went there first, there is but very little water in comparison to what we had 25 years ago. When I went there the river always had water in it the year round, every day, 365 days in the year. For the last four or five years there have been months at a time that the river has been perfectly dry. This is more especially early in the season. During the summer season there has been but very little water. During the early years, along in June usually, we had what we call in this country the June rise. The river at those times would be full from bank to bank. During the past few years we haven't had that rise every year to any
1687 great extent. We began to notice this falling off in the flow of the river about fourteen years ago—about 1890. It has diminished gradually since. My best judgment would be that during the last four or five years at least four months in the year the water doesn't run to amount to anything, and the flow during the remaining months has gradually diminished.

I have had occasion to notice the level of the water in the wells along the bottom. During my residence I have dug at least six different wells since 1879 on my place at Lakin. The water at that time was about twenty feet from the surface. These wells were dug as stock wells and about ten rods from the well I dug in later years. In the later well I had to go a trifle deeper for the water, and for a ranch well I had to go still deeper.
1688 The lay of the country would indicate that in that last well water should have been struck before my first well, but it wasn't. Since then by moving the house and corrals I was forced to dig two more wells in which I had to go still deeper for water, and this spring my son-in-law on part of the same place, dug a well and the water was at least two and a half feet farther in the soil than it was when my first well was dug in 1879. In 1881 I built the first fence around my farm in Kearney county. In building my fence across the bottom I struck water in nearly every post hole on the bottom. This spring I was repairing the fence, whereby I had to dig post holes, and I struck water I

think in only three different places, which showed that the
1689 water level had dropped. (Objection.) I have been in the habit of cutting hay on the bottom lands since I have lived there. I cut my first hay in 1881 or 1882. I was cutting hay last week, wild prairie hay. As to the comparison in the yield of the prairie hay on the bottom lands, there is not one-third as much hay now on the bottom as there was when I first cut it in 1882. Then it was very heavy, so heavy in places that I had difficulty to tell where I had already cut, it was so thick. I had no trouble this year in that respect. In 1882 I think we had about two hundred and fifty tons on one hundred and fifty acres. Last year I had
1690 my hay baled and sold by weight. I had something like eighty or ninety tons, perhaps, on one hundred and fifty acres. That was about an average crop at the present time. In my judgment I attribute the cause of this falling off in the wild hay crop to the ground—the earth being dried up, or the water falling—leaving the surface. There has been no change in the rainfall to account for it along the bottoms. (Objection.) If anything, there is more rainfall that stays on the ground now than there was twenty-four years ago. In my judgment the dropping of the water level on the bottom is because there is not so much flow in the river to fill up the porous soil. (Objection.)

Recross-examination.

By Mr. DAWSON:

1691 There was a very small settlement near where I live when I first located there, and it is very small now. The balance of the country is fenced and is used for stock raising, feeding and grazing. I first went into the country in 1879. I probably saw a notice of this litigation between Kansas and Colorado in the paper since it was instituted.

I have never constructed any irrigation ditches except
1692 laterals from ditches that I watered from. These laterals draw their supply from the Amazon and Great Eastern ditches on the north side of the Arkansas river. The Amazon
1693 canal is about 22 feet wide at the bottom, and it will probably carry two and a half feet of water—perhaps three feet. I don't know about the grade. I think it is about eighteen inches to the mile, and the ditch is forty or fifty miles long. The water is used
1694 for irrigation. The Amazon ditch covers several thousand acres of land. I have about four hundred acres in my place and there are three hundred acres broken. Sand creek cuts off a piece that it is impracticable to get the water to, and also the Amazon cuts the farm in two so that some land is above the ditch. I have no land
1695 of my own from which I cut wild hay. I rent one hundred and fifty acres. I don't irrigate this rented land; it lies along the river bottom. I do irrigate the three hundred acres of my own which I have under cultivation, or I have irrigated it. Where I

dug the well, the land is about twenty feet higher than the
1696 river, and I went down about twenty feet to strike water. That was the first well. It was a mile from the river. The second well was only twenty rods from the first one, just about the same distance as the first from the river. In the second well I went about twenty feet to water also. That was dug about 1885. The third well is half a mile from the first well, and nearer to the river. In the third one I went twenty-two feet to water. I don't think there is any great difference in the elevation of the ground at the third well and at the first two. If anything, the third well is a
1697 little lower than the first and second. The ditch has been running across the land near the third well since 1881. The
1698 well, however, was dug in 1885. The ditch was not in existence when I dug the first two wells. I don't irrigate the ground around the well. The nearest point irrigated is ten rods. I do irrigate ground higher than the wells from the Amazon ditch. For a time after the construction of the Great Eastern ditch there seemed to be a rise of water in the well, but since that it has
1699 subsided, but the ditches have continued to be used in the years since then. I am not now using the three first wells I dug. I just let them go. Being open wells, two of them I covered up. I covered up or destroyed one well in the latter part of
1700 the '80's. Since that I don't know how high up the water would come in that well. The other well lasted, I think, until 1896, perhaps later, when I covered that up and put down a new well. Since 1896 I don't know how high the water would come up in that well, but at that time I bored or drove down a well close by the first two. In driving for water I had to go about twenty-two feet, something like that.

1702 Part of my land is under the Great Eastern ditch and gets its water from that ditch. The Great Eastern heads in Kearney county about three miles west of Hartland. It is, I believe, 20 feet wide at the bottom, two and a half feet deep, and about two and a half feet fall to the mile, I think, where it runs through my place. I am acquainted with the ditch for about twenty miles. I don't know how much longer it is. It covers several
1703 thousand acres of land and is used for irrigation purposes. The flow of the water in the river this year is better than it was last year. There is more. My crop has not been as good this year as it was during the earlier years, and there has not been so much water in the river. There has not been sufficient water in the river to hardly cover part of the bed at times. Where I cut this native
1704 hay the ground may be two and a half feet above the water in the river. On the uplands in my vicinity the grass is better now than it was in 1879. Before 1879 these prairies were burned over, from the Smoky clear to the Arkansas river, by prairie fires. We have grass enough now to make a prairie fire, but since
1705 they put in stock and fenced the land they have kept the fires out, therefore the grass on the upper plains is a great deal

better now than it was in 1879. In the early days the stock ran on the open range and tramped it over and ran over the whole country. At the present time these large prairies are fenced in large pastures, with wind mills all over the country. Small bunches of cattle are kept all through here. I expect there is more cattle kept in
1706 western Kansas to-day, west of Dodge City, than there was in 1879. They farm the upland now in my neighborhood and raise the best wheat, oats and barley that is raised in the
1707 country, without irrigation. They use irrigation some in the valleys. They raise these crops without irrigation clear through on the uplands, and they have been doing that at least ten years. I think there is less acreage of upland under cultivation now than formerly. Fifteen years ago every quarter section of that county on the north side of the river was taken up by settlers. They broke up small pieces and went in with good heart to raise crops. They were not successful and abandoned the country. They couldn't raise crops because of the small amount of rainfall. Some stuck to the country and have raised crops. They have farmed year
1708 after year and have raised good crops, but not a sure crop. They get a crop oftener than they did in the early years. This must be because of more rainfall; that is, our rains are different now than twenty years ago, better distributed throughout the season. I attribute this to the settlement and improvement all along the valley. The irrigation of large tracts of land in Colorado may have tended to equalize the rainfall here. After those first people settled some fifteen years ago the land returned to its wild
1709 condition. I saw that country settled and depopulated three different times. In 1879 the whole country about Lakin was taken up, and they went away in 1880 and 1882 and 1883. In 1886 the settlers again came in there and made another effort and were driven out by dry weather. In 1889 again settlers came north of the river. In 1887 the two crops of settlers that had been
1710 here before had practically all gone out. Again, in 1889 and 1890, they all left, with the exception of a very few. They are not there now. There are only a very few people there that amount to anything. In our two northern voting precincts of Kearney county the voting population, I believe, is only about fourteen.

1711 There is more water in the river this summer than for some years past—a better flow. We had some water in June, noth-
1712 ing like what we used to have, and in July the flow of water in the river was fairly continuous. In August, this year, there was a little water, but not what we might call running water. There was a little water running past my place in the river all during the month of August. The Amazon and Great Eastern ditches were both carrying water all during the month of August, practically. There were days when they had very little. They were carrying a light supply of water. These ditches were neither there in 1869. I think the Great Eastern got as far as my place in 1881.

They had some trouble when they got to Sand creek; it runs
1713 across my place. The amount of water in the two ditches at the present time would not have affected the river in 1879, in my estimation. It was a pretty good river in 1879. I have crossed it on the ice. I didn't see the river in 1877. I was not then in the State. Since I came the river was never dry until it
1714 got away up into the '80's. 1880 was one of the driest seasons I have ever experienced on the river, but I know from crossing that the river was never dry during that year. At times the water got shallow, but never dry. In 1880 there was just as much water there in the Arkansas river as in 1879. The drouth did not affect the river.

I think the snow in the mountains has something to do with the river, more than the rainfall here. There is not a drop of water that I know of from Bridge creek, in Hamilton county, to Coon creek, I think, in Edwards county, where there is any water goes into the Arkansas river from the north. It goes into the ground, but I never as yet have seen the time but what the water that fell on the high grounds was absorbed by the earth. The fall of
1715 the ground is toward the river. I am one of the people who believe in an underflow, and if the water goes into the ground and the fall of the ground is toward the river it must go toward the river after it gets under the top of the ground, but there was not enough of it to affect the river. When there were heavy rains in Colorado or in the mountains, as at the head waters of the Purgatoire or Arkansas, we used to have a big
1716 flow of water here, and even do now from the Purgatoire, but the water that comes from the rainfall up there only lasts a short time. The Purgatoire comes in below a great amount of ditches in Colorado, and perhaps below all of them. It comes from the south, from Raton, and I don't know of anything that has particularly interfered with the flow of water in the Purgatoire
1717 and its supply to the river. I have been up in Colorado, but never any farther west than up about Holly. I know in a general way from talk and reading that they were irrigating in Colorado for the last ten or twelve years, and I have never made any complaint or lodged any objection against Colorado doing this, and have no personal kick at this time. I am probably raising as good crops as I was seven years ago, and the land is worth every bit as much to the acre as it ever was. It is worth a little more.
1718 The lands of my neighbors have not depreciated. This year the crop has been a failure on account of the grasshoppers. In boom times the land went away up extravagantly, but outside of boom times I don't think they would take any less now for
1719 land than it has been. If the Amazon or Great Eastern ditch, or either of them, were taken away or prevented from running water the land would be valueless except for grazing purposes. Land under ditch is worth about twenty-five dollars an acre, and outside of the ditch about three dollars an acre. There is a differ-

ence of say twenty dollars. In this part of Kansas along the Arkansas river the right to irrigate with water from that river is of vital importance. This is generally recognized as a fact by our people, who look forward to a larger use of the water for irrigation in some way, and they are making efforts constantly along that line.
1720 It is my idea that if this suit would cause the Colorado irrigators to remove their dams from the river that would give our people a chance to get more water for irrigation. (Objection.) I do not object to Colorado using the water as long as we get
1721 water for irrigation. (Objection.) I would not want the dams which have been constructed by Colorado irrigators taken out simply to let the water run away. (Objection.) Not just to let the water run down. If it be true that the issue in
1722 this case is that Kansas wants to establish the principle that no water shall be taken out of the river for irrigation purposes but that the water shall be allowed to run down the river to its mouth, I am not interested in that sort of a proposition.
1723 I have no interest in the Amazon ditch. I merely rent the water from them.

The Great Eastern ditch is the one that Senator Swink of Rocky Ford is interested in. I believe he is one of the big stockholders, and it is owned by several of the boys here about this town (Garden City, Kansas). I have no interest in it, but I rent water from them. I took my land up in 1879; that is, I took steps to take it, but if that Great Eastern ditch had not headed across my land I
1724 should have left years ago. I couldn't have stayed. It was because of the existence of the ditch there that I went ahead and proved up on the land and took title from the Government.

Cross-examination.

By Mr. CAMPBELL:

The wells I have testified to are about twenty-three miles from Garden City by the railroad, and in the neighborhood of forty miles from the Colorado State line. The Amazon ditch heads near
1725 Lantry, Kearney county, Kansas. It seems to me that ditch was not built until along in the latter part of the '80's. The water has been running in it more than ten years, and it has been used for irrigation purposes during that time and ever since the water has run in it. There is not as much water for the ditch
1726 now as when it was constructed, but it will carry as much as it did then if it were cleaned out. There is not as much water in the Arkansas river now for that ditch as there was when it was constructed. When it was constructed they could fill the ditch. At the present time they take all the water they can get and cannot fill it. When there is water in the Arkansas river they can get it in the ditch when the dams are in running order, but there is not so much water in the river as when they first opened the hole into it.

I get water from both the Amazon and Great Eastern. The
1727 Great Eastern was constructed in 1881 and water has been running in it ever since it was constructed, comparatively speaking. There is not as much water for it now as there was then. I cannot tell how much it has decreased, but to a great extent. There is nothing near the flow in the river—not half as much. There can't be when the river is dry five months out of a year. Then it was running all the time. What I say in regard to the Great Eastern ditch applies also to the Amazon ditch. I know of other ditches constructed in Kansas to take water out of the Arkansas river for irrigation purposes, namely, the Minnehaha. They didn't get water enough up the river so they changed
it into the Western. The Minnehaha was constructed
1728 before the ditch on the north side. Ours is the Great Eastern, on the north side. That is another ditch on the other side of the river—the Western. They were constructing the Western in the early '80's—1882 or 1883. I can't tell when the water was turned into the ditch; perhaps about 1885. The first ditch I ever heard of
was this one that heads up here. I guess now it is called the
1729 Kansas ditch, right west of Garden City. It was gotten out for manufacturing and one thing and another, and when it got to a certain point they commenced irrigating from it. It was constructed as early as 1880, and perhaps 1879. I think water was turned in as early as 1880. There is another ditch that comes out very near Deerfield; it must have been constructed as early as 1881. The water was turned in the same year or directly after. There is
a ditch at Kendall and one at Syracuse and one at Coolidge.
1730 They have been used, I think, about fourteen or fifteen years, along there, for irrigation purposes.

Redirect examination.

By Mr. SMITH:

When the Amazon and Great Eastern ditches were first constructed they had a pretty steady flow of water. It continued down to about 1890 or 1891. For many years after 1890 there was practically very little water in these ditches, especially in the growing season. During July, August and September, there was practically none; in fact up until this year that has been the case. We had hard work to get water. We had to take it in turns. This is the first season
we have had water for quite a number of years during the
1731 growing months. There has been more water in the river this year and more rain this season than heretofore for some time. There have been more floods this year in the river. Prior to this year these ditches have been of very little value for irrigation purposes, except in the spring, and not early in the spring then. The first water that had been in these ditches for several years was about Decoration day. We would irrigate our alfalfa once or twice, and that is about all that we could do. Last season I irrigated but

once. If these ditches were carrying the water and had the flow that they had when they were first constructed our lands would be of far greater value than they are at the present time, and the fact that the ditches do not get the water has rendered our land less valuable than it would have been if we could have kept up our irrigation with a full supply.

Recross-examination.

By Mr. HAYT:

1732 If these ditches have been in litigation and the subject of foreclosure proceedings I know nothing about it.

Q. Is it not a fact that the ditches were allowed to fill up and were not cleaned out for a number of years?

A. There has been considerable sediment gathering in some of the ditches, yes, sir; but there has been no time when there has been water in the river, and the headgates have been in shape, but what they made an effort to turn in water.

Q. But very little effort was made towards repairing the ditches during the ten or twelve years prior to the last two or three years? Is not that true?

A. The Amazon ditch has always been in repair, I think; the other, the Great Eastern, or whatever it is, I think there has been no year when they were trying to run water but what they have run water in that ditch. There was one year that there was no water run because Ed. Russell determined to make the railroad company make some concessions to the ditch and sell land cheaper, or
1733 something of that kind, but that was years ago when there was no water in the river.

The farmers became the owners of the Amazon ditch this spring. The other ditch the farmers don't own; it belong- to a company. There has not been a dollar's worth of work put on the Amazon ditch this season, since the farmers acquired title. The Great Eastern, after Swink and some Garden City persons bought it, they went to work and put on several thousand dollars' worth of improvements. Prior to that time it was in poor condition, but then water was run through it last season. I know nothing about the Garden City ditch.

1734 JACOB B. STILLWAGON, Garden City, Kansas.

Direct examination.

By Mr. ASHBAUGH:

I live twelve miles west of Garden City. I am seventy-two years old and have lived there about twenty-two years. I came in 1882.

I own 360 acres of land which is situated one mile along the
1735 river on the north side. One hundred acres of it is bottom land. The bottom is from forty to sixty rods wide. I am

somewhat acquainted with the flow of the Arkansas river from the year 1882 down to the present time. During the first ten years that I knew it we generally had through the summer time—the river bed would be from half full to full, sometimes out to the banks. During the last few years, with the exception of 1904, the water has been generally very shallow, except this year. This is an unusual year on account of so many water spouts. Last year the water was a little lower. There was not so many water spouts up there. We always get them down here, if we don't get anything else. Last year
1736 the river was dry for about eight months, I guess—from about August to some time in May. From August, 1903, to May, 1904, the river was dry, with no flowing water in it at all. The water has decreased upon my bottom lands I presume about two feet. The water don't rise up like it used to. In low spots the water used to stand on the ground where there was a little slough, you know. There has been no water standing in those sloughs for about eight or nine or ten years. The water level has been about two feet lower during the last year, and, it has been that way for a number of years. I used to mow my bottoms every year until the last eight or ten years when I don't mow it because I don't have water enough to make it grow. I grow mostly cane on there. That will grow most anywhere. We also had alfalfa, wheat, oats and other grains. Alfalfa I raise on the uplands. I have about five acres on the bottom
1737 lands. I have known of others having alfalfa along the Arkansas river on the bottom lands also. The last six or seven years the crop has been a great deal lighter, because, I expect, we haven't had the amount of water in the river that we used to have.

I have observed the current to the underflow. I know where the water used to run pretty lively it don't run, hardly, any more. I could see where it ran out on the bank underneath it. I call it an underflow because the water runs out from under the bank. I have about 250 acres of land that I could irrigate.

1738 Q. How has the water been in the ditches for the last three or four or five years, excepting the year 1904?

A. Well, I am under the Great Eastern, and we haven't had any water until this summer. We didn't have any water last year, nor none the year before, but this summer we have had some water.

Q. How was it in 1903? Did you get sufficient to insure a crop at all or to mature one?

A. Well, we were just as sure as the summer came around. We always raised a good crop.

Q. Well, in 1903?

A. Oh, 1903? No, sir. Of course we raised—all the crop we raised was—well, we didn't irrigate. It was by the heavy rains we had here.

Q. Well, could you irrigate in the year 1903 with the amount of water you got?

A. We didn't get any.

Q. How about 1902?
A. It was about the same way.
Q. Now, did you get water sufficient in those irrigating ditches under which your land lies when they were put in there in the first place?
A. Yes, sir, all we wanted.
Q. For how many years or down to what time?
A. We had water from the Great Eastern from 1888 to 1895.
Q. Since 1895 you haven't had any, have you?
A. No, sir. We have had some.
Q. But did you have enough to supply your wants at all?
A. Well, we got enough to water once.
Q. When did you first notice the underflow falling?
A. I think about 1897 or 1898. Well, I think it was in the winter of 1898.

Cross-examination.

By Mr. HAYT:

1739 I first located where I am now in 1882. I formerly lived in the eastern part of Kansas, in Allen county. I lived there for twenty-six years. I came there in 1857 and settled on the New York Indian lands, and consequently the land was not on the market and so we didn't make much improvement. We just kind
1740 of loafed around. We were not sure whether we would get the land or not. I commenced farming in 1865. At the time I moved into Finney county I came here with the expectation of raising crops by irrigation. I came here from California for that purpose. I had observed irrigation in California before locating in this county. I saw in the Kansas City Journal that they were farming here by irrigation and what they could raise, and like a great many others I thought I would come and make a stake. The fact that they were advertising that crops could be grown here in profusion by irrigation is what brought me here.
1741 I was in Colorado in 1896, but I didn't know of irrigation in Colorado prior to the time I located here in 1882. It was seven or eight years after that before I heard about the irrigation in Colorado. At the time I located I didn't know they were taking water out of the Arkansas river above for the purposes of irrigation. On my return from California I came by the Southern Pacific, and came through La Junta. When I came here I didn't know anything about the rain here. I knew it was middling dry. The purpose for which I want water at the present time is for irri-
1742 gation. If it was not for the water I would get out just as quick as I could, because you can't raise crops without you have the water. In other words, a farmer can't live by farming in this community unless he has water to irrigate his land.
1743 I am the owner of lands abutting on the river, and I am interested to get the water, if I can get it, for the purposes of

irrigation. I am not interested in keeping the people of Colorado from getting the water. I believe there is water enough for
1744 all if it is used right. (Objection.) The way I understand this suit, it is to divide up the waters between Colorado and
1745 Kansas for the purpose of irrigation. (Objection.) Yes, in answer to a question propounded by counsel I said that I called this water in the ground an underflow, because it runs out from under the bank. That is correct. On my land it runs out close to the lines of sections 4 and 5. That is where it runs out the strongest. There is an island between me and the river; it is where the river used to run a good many years ago and now there is a large island formed there and the river runs on the other side, and where this old river bed used to be the underflow runs out from under that. It runs out from the old river bed into the river channel and gets back into the river about two hundred yards east of that, and the reason I call it an underflow is because it runs out at these points. It runs the whole year round.

1746 I take water from the Great Eastern ditch for irrigation. There is another ditch that runs right through me for a mile, called the Kansas ditch. It heads about two miles west of me and about thirteen miles from here. I should judge that the Great Eastern ditch was commenced about 1880 or 1881 and they were working on it when I located here. We have no water rights yet on that ditch. I am not an owner of the ditch in any way nor a stockholder in the company. I could irrigate about 240 or 250 acres from that ditch. During the first years I was there I irrigated about 40 acres. That was the first irrigation I used, about
1747 1888. This year I irrigated more than that—I presume between 80 and 90 acres. After the water commenced to run, I think it was in about July of this year, there was water in the ditch all along until about two weeks ago. I am raising cane and alfalfa. I had in some other crops but couldn't get the water and they went back. I had in 90 acres of wheat, 60 acres of barley, about 35 acres of oats and 15 acres of squashes and melons together. They dried out because they didn't get any water. We had some grasshoppers up here. I didn't seem to have as many as some of my neighbors, but they have been pretty bad in this neighborhood this summer and have destroyed the crops generally.

For the last two years the Great Eastern ditch was out of
1748 repair, but now it is in first class order. I think there was a change in the company about a year ago. That change did not result in the farmers in this locality becoming the owners of that ditch. The last two or three years I don't think the land up there has increased very much in value on account of the scarcity of water, but prior to that time land was advancing and we had plenty of water. Generally there has been an advance in price since I located there, because when I first located there there was nobody living there much. This last year and 1902 it seemed very

discouraging because we thought we were not going to get
1749 any water. I consider my land worth twenty dollars an acre at this time. I attribute the value to the improvements that are on the land in the way of ditches and all kinds of improvements. It wouldn't be of much value if you didn't have the water, but with plenty of water to irrigate it is worth twenty dollars an acre or more. I have seen the river dry in 1896, but I don't remember how long. I was up in Colorado that year and it was dry
1750 at La Junta. I believe there was lots of water in the river in 1884. I don't remember the river being dry about 1884 between Dodge City and the Kansas line. I know I had a bunch of cattle and I drove them to the river every day. The river might have been middling low about that time, but I know I had to cut ice in the winter. I don't believe I ever saw it so low during those early years that there was not much water running in the river, because in those days I lived close to the river. Generally in the winter time up to about 1895 there was always considerable water in the river. I never remember of its being as dry as it was last winter. It gets low every once in a while, but it comes up
1751 again. Of course it gets low when you are using all the water up in Colorado. That is the reason the water is low. Of course we don't get it. 1896 was the first year I remember the river being low in the summer time. I lived within 200 yards of the river then in the early days. Previous to 1895 there was
1752 always lots of water. As near as I can remember the flow averaged about the same during the first five years I was there as it did the five years from 1890 to 1895.

Cross-examination.

By Mr. CAMPBELL:

The Great Eastern ditch, from which I got water for irrigation purposes, I don't know its exact length. I presume it must be about fifty or sixty miles from the head to the end, and about 32 to 40 feet wide at the bottom, and is about three and a half to four feet
1753 deep. I believe this ditch irrigates between seven and eight thousand acres; that is what they can irrigate from it. The years when the most land was irrigated were from 1889 to about 1890, and it is less now than it was in 1895, because a great many people have moved away. A great many people moved away because they didn't get the water. I can't tell how many acres this
1754 ditch irrigated in 1895. I have heard that between seven and eight thousand acres are irrigated from the Kansas ditch, which is about thirty-five feet wide. There is not so much land irrigated by that ditch as there was in 1895, the reason being that so many have moved away because they didn't get water, the volume of water in the river decreasing.

Redirect examination.

By Mr. ASHBAUGH:

1755 The value of our land is not as great as it would be if we had as much water now in the irrigating ditch as we had the first year or two that the ditch was operated. It would be worth as much again. The cause is the decrease of the water in the river, because it is used up further west. We first noticed the river beginning to decrease in volume in 1897 or 1898. (Objection.) I don't know when the ditches in Colorado were put in. I judge it may have been in 1894 or 1895, as much as I know. The river decreased immediately after they put the ditches in in Colorado. (Objection.)

1756 GEORGE H. REEVE, Garden City, Kansas.

Direct examination.

By Mr. ASHBAUGH:

I live in Garden City, Kansas, and at the present time am register of deeds for Finney county. I am a farmer by occupation. I have lived in Finney county since October 5th, 1880. I have had several farms in the county. I have rented some land on the river bottom adjoining the river; that is, in the early '80's. I am somewhat acquainted with the flow of the river during the dry season of
1557 the year ever since I have been here. As to the average flow of the river during the dry season of the year, the river used to almost continuously have water in it through the summer season and the winter too. There was such an occurrence in the early years as the June rise, usually about the first of June, and it lasted from two to six weeks, that is, until the river would go down to its natural flow. They usually came very suddenly, but they would go down very gradually. During the last ten years, excluding the year 1904, during the same seasons of the year, we have had no flow except through freshets. There is no natural flow any more. We have our freshets, and when that passes down the river it is dry, except in the winter we sometimes have a little water during the
1758 freezing cold weather. I don't think the June rises are as large as they used to be, but the greater difference is in the times when we have the rises. We have no water at all only from freshets now. The river was dry from July or August, 1903, until May, 1904. It was absolutely dry, void of water so far as flowing is concerned.

The underflow is a current of water under the ground. It is a sheet of water stretching across the country for a considerable distance both north and south. I put a well down at Scott City in 1880. We struck a sheet of water. It was in February of 1880 that we put down the well. I think there is a current to this water

in the Arkansas valley. That current flows down stream,
1759 eastward, parallel with the river. As to the effect the decreased amount of water in the river has had upon the underflow, it has lowered the underflow from two to three feet. My ranch that I had for twelve or fifteen years I sold a year ago last spring. It is north of the town about six miles. There are 1120 acres in it, and I have a number of wells, and I used to strike water in those wells at that place. I used to dig my wells in the early days and I would strike water at thirteen to twenty feet, and it was always in sheet water, and for the last eight or ten years the water has gone down until I have been obliged to put in tubular wells. There was not sufficient water in that sheet water to supply the stock. The effect of this lowering of the underflow upon the crops along the valley of the river has been to ruin the crops in the valley. Now there is some land here that used to be very productive in alfalfa that will not grow it any more without irrigation. There are other pieces that lie lower that still grow fine hay, where it is shallower to the water. I know one piece west of town here. I used to own a claim adjoining it. It used to be very heavy hay land, and as the water got scarcer and it was deeper to the water the hay got shorter. It produced
1760 more seed and lots less hay. They have irrigated the land, and they didn't cut it at all when they first put it in alfalfa in the early '80's. I could only give an estimate as to the extent of the alfalfa crop in the valley being injured by the lowering of the water. It is heavy, though. I think the lowering of the water in the valley has injured the hay crop one-half. I first noticed the decrease in the flow of the river and the lowering of the underflow ever since they commenced building the large ditches in Colorado. The water has been getting scarcer in the Arkansas river. I presume that is the cause of the lowering of the water in the Arkansas valley in the underflow.

Cross-examination.

By Mr. ROGERS:

1761 I took the office of register of deeds a year ago last January, the 9th. I was county surveyor years ago. I am acquainted with the people generally throughout the valley in this county and I have heard this case talked of and have read of it. I have heard it talked of on the part of the people living along the river. I think the people down here know something about this suit. I have not heard them talk about it to any great extent. I presume they take some interest in it. I have heard some of
1762 the farmers along the river here express themselves, but I don't know as I could recall anything they said. Not to any great extent. (Objection.) I refer to the owners of the lands on the bottom here. I have heard them say that if the water was in the river like it used to be the land would be worth much more

than it is and they could produce much more, and as it is, without water in the river, it is an up hill pull. (Objection.) When this river rises the water expands out under the soil and rises up level with it where it is in the river and sub-irrigates
1763 their alfalfa and trees and all crops for that matter. What little water is taken out here don't affect the river to speak of. They are small ditches. There probably is some complaint made of the taking out of the water in ditches in Kansas. I don't know that I have heard anybody complain of it. I have not heard them say they wanted this suit maintained, but I have heard them say they could grow much more if there was no water turned
1764 out in the ditches. I think I have heard a complaint of the ditches taking water from the river and injuring other farms that were previously sub-irrigated. I have heard such talk.

I first observed the decline in the volume of the water in the river about 1890 to 1891 and 1892—along there. My recollection would be that up to that time the water in the river had annually been about uniform in volume. Some years we have more water than others, but we always could figure on water to water our crops throughout the season up to about that time. Some years the amount was greater than others. That is always the case. The average flow throughout the years prior to 1890 was greater
1765 than it has been since. As to the year at which there was a marked change in the flow, of course it was a good while ago and there might have been some years it was drier than others or less water in the river from some cause, but I don't recall just what year it would be, if any. From 1890 to 1892 the water began to get scarce.

I helped to put a well down at Scott City in February, 1880. Scott City is thirty-six miles north of this town and thirty-six miles north of the Arkansas river. The same sheet of water we have here extends as far north as Scott City. I know that to be a fact.
1766 It was about 28 or 30 feet in depth that we found the water at Scott City, I think, but I don't recollect just the distance. That was the top of this underflow. The last I knew of that well it was under the corner of a building, or under a side-walk. It was not being used the last time I saw it, because they have put in other wells and it happened to be off the street and was under the corner of the sidewalk or under the corner of a building or something; it was out of sight. I don't know how much higher Scott City is than the Arkansas river, only judging from the depth of the water. I think the depth of the well was something like 28 to 30 feet. I am not sure of that.

1767 I think the water in Beaver creek, seven miles farther north, which has water in it all the time, is on a level with this underflow. I don't know that I ever saw this water in Beaver creek vary much in volume. I have not been on the creek for a good while to amount to anything. It is eight or ten years since I

have seen it. Maybe over ten years; probably fourteen. The
1768 well on my ranch seven miles north of Garden City was a dug well, and I put up a wind mill and got along very nicely with it for two or three years watering my stock. I went there in 1891, but after a year or two the water got so it was not in abundance and it would pump away and I had to go to work and sink down to the second water to get water enough to supply that pump to water the stock. The first time I sank I found water at about twenty feet, at the house there, and it went down to about twenty-two or twenty-three feet. It was just sand water—sheet water—the same as we have here. About 1893 or 1894 I sank the well deeper and put a galvanized casing down to the second water, which was 48 feet. When I say second water, I mean there are three
1769 sheets or water here. At that farm the first water was about 20 feet. It was probably three feet deep through the sand until we struck clay again. This clay is pretty solid, so solid that you couldn't drive the casing through it. We had to bore a hole down, and at a depth of forty-eight feet I struck another sheet of water. We went probably five or six feet through the clay and then struck sand and water. It is fine sand at the top, and down at the bottom it is gravelly and that is forty-eight feet from the surface. As to quality, the second sheet of water is much the best compared with the first, and the third is much softer than the second. The first sheet is alkali water, back north as far as my farm,
1770 as bad as river water, and the second water was soft enough so that the women folks did away with using lye; and then I put a well down in the same yard, seventy-three feet, and that was as soft as rain water. It is the first sheet, which I think extends to the river. There is probably a flow under it. I never examined the water to find out whether it is exactly the same water at Scott City as it is at the river, and I never ran any levels to find out whether the elevation was the same at all points. I guess I simply speculated on its being a sheet of water underlying the whole country.

1771 I know of wells four or five miles south of the river in the sand hills. I put down four south of Deerfield, in Kearney county, myself, in a pasture, the first well being six miles south of the river. I found the same sheet of water there. The only wells I know of within five or six miles of here where the water level has been found ten feet or so above the water level of the river is in deep wells. The water always rises in the second and third sheet above the first sheet. It will rise so that it is higher than the sheet water in the same well. In other
1772 words, if you put in a tubular well with an iron casing the water in the well will stand two or three feet above the water in the sand right at the same ground. The water level of the river is the water that is in the sand, the first water; the other is what you might call artesian water. It rises of itself. I think that water rises to a greater height than the level of the water in the river. I don't know that Scott City is two hundred feet higher than the

river at this point, and I wouldn't have thought it. If that were true I don't know but it would rather impair my theory. If
1773 the water in these wells some distance back from the river is higher than the water in the river it could not be the same sheet or it would hunt its level. I don't know that that is the case. I don't think it is.

As for getting the moisture to start alfalfa here, we have rainfall enough here to start it. There is always enough if there is any rain to start it. It may die soon after, but we usually have moisture enough in the spring of the year from the melting of snow and the winter moisture to last long enough to start the alfalfa in the spring. Sometimes we don't have it dry here until midsummer. There are thousands of acres in this county along the river where they have gotten alfalfa rooted with nothing but the rainfall, that never was irrigated. There is alfalfa here
1774 in the bottom that has stood twenty years to my certain knowledge. Some of it has been injured by the lowering of the water below the bottom land. Some of it is yet shallow enough to be plenty wet. The sheet water will vary from four to sixteen feet below the bottom lands here in the valley. When it is four feet it is a little too shallow for the alfalfa—a little too close to the water. The alfalfa won't stand it where the roots run into the water. There are places in this valley where it is only four feet to water. This is considered alfalfa land. There are other places where it is sixteen. Where it is only four feet it is a little too shallow for alfalfa and not a great deal of that land is in alfalfa.
1775 About eight to ten feet is what they like. The water can be drawn off so that the surface of the water table will be eight to ten feet, and that will make short hay, but it is good seed land at about six feet. That is what they call the best hay land, where it is six feet to water. I mean alfalfa hay land. Ground where the water is sixteen feet below the surface will make seed alfalfa. It will be thin on the ground, maybe, and probably short, but if they can manage to save it it will be loaded with seed. I have seen alfalfa that was not near a foot high and it would be loaded with seed, that is, it would make a big yield per ton but small per acre. The surface of
1776 the bottoms here is about three to four feet higher than the bottom of the river. Sometimes much more than that. The first bottom is usually hay land and the alfalfa bottom is the second bottom, and it runs from four to fourteen or sixteen feet. It is the prevailing condition throughout this part of the valley that the bottom of the river is from three to five feet lower than the surface of the bottom lands. The first bottom, the river bottom, is
1777 from no width at all to a half mile. That is the first alkali bottom. Then the second bottom or alfalfa bottom runs different widths, sometimes very narrow and sometimes two or three miles wide. Garden City is fifty-one miles west of Dodge City. The bottom is very different here from what it is up and down the

river. From where we are here it is two miles of table land right north, and it is half a mile south to the river. The bottom
1778 land at this point is less than half a mile wide. The second bottom I speak of does not touch the river at any point close to Garden City. At Deerfield I think it does. There doesn't seem to be anything but the second bottom there right up to the river bank. The bank there is about ten feet deep. Wherever that first bottom happens to be it is narrow. Originally I suppose it was river bed. That land would be benefitted by more water. It is not alfalfa land, it is a wild prairie hay land, blue stem, and they don't
1779 get near the blue stem hay off it they did when there was more water in the river. I don't think the soil is right for alfalfa. It is a sandy soil, and is alkali.

I know something about the assessed valuation of land in this county. The assessed valuation has not been changing very much in this county in recent years. Land has advanced here, but nothing compared with some parts of the State, and the ranch and grazing land has advanced in proportion a great deal more than lands along this bottom—than the farming lands along the ditches. But the bottom lands have advanced somewhat. I don't know of any land in this locality that has declined, and nowhere else. Lands have advanced generally, I think, all over the country.

1780 In reference to the wells which I put down about six miles south of Deerfield, I found the water at a depth of forty-six feet in the first well and fifty-five feet in the one three miles farther south. I think that was five or six years ago this last spring. The well is right near the center of township 25, 35. I don't know
1781 that at a point six miles south of Deerfield we would be sixty feet above the level of the river, nor that at the other point nine miles south of Deerfield it would be eighty feet above the river. It is just ten feet deeper to water—fifty-five to fifty-six feet.

Redirect examination.

By Mr. ASHBAUGH:

As to the quality of the first bottom land along the river where it is not over four feet to water being good alfalfa land, I said that the soil was not adapted to alfalfa. It is a cold-natured soil, a kind of gumbo. If the soil near the river was of the same quality as the soil farther back it would not be as good for alfalfa as if it
1782 were a little deeper to water. I think the best alfalfa land depends upon the quality of the soil as much as on the water, as I have stated above. (Objection.)

As to the uplands having advanced a greater per centage than the bottom lands, I will say the uplands have not been affected by the scarcity of water in the river in the last few years and the bottom lands have.

Recross-examination.

By Mr. ROGERS:

When I speak of the uplands I don't mean land under ditch in this country; I mean the grazing lands and ranch lands—
1783 outside lands. I should say that from three to ten dollars an acre is the selling price generally for strictly grass lands. As to the bottom lands, land to produce good alfalfa has been sold as high here as sixty to seventy dollars, and that kind of went back on the farmers and would sell cheaper; that is, it is worth from ten to seventy dollars an acre. I don't know any piece of alfalfa land where the ground is only from two to three feet to water.
1784 We consider four feet here shallow enough, and six feet is often considered the best alfalfa land. That depth to water might vary somewhat in other parts of the county, according to the soil.

L. P. WORDEN, Garden City, Kansas.

Direct examination.

By Mr. ASHBAUGH:

I live in Syracuse, Hamilton county, Kansas, and have lived there since 1885. Hamilton county is on the Arkansas river and
1786 the first county east of the State of Colorado. My business is flour, feed and coal. I own 350 acres of land, one mile west of Syracuse, all located on the north side of the river. It is all bottom land and adjoins the river. The Arkansas valley at Syracuse, and especially at my place, containing the first and second bottoms back to the uplands, is about a mile and a half wide. There is quite a difference in the width of the valley in different localities. Down about Kendall in the eastern part of the county it is a good deal wider, and it is also a good deal wider at the west part of the county up near Coolidge. The valley I think through the county would average from one and a half to three miles wide.
1787 I am acquainted with the flow of the Arkansas river since 1885. I have lived there all the time and have been there all the time and have been in touch with it all the time and have had occasion to notice it as it flowed from year to year. During the first seven years, during the dry season, we had a pretty good flow of water most all the time, enough to raise good crops. For the last ten years, excluding the year 1904, we have had very little water excepting in flood times, except in the winter when it is moist or warm enough so that we can irrigate. We can generally get a little water in the winter. During the dry seasons of the year for the last ten years, excluding 1904, the river has been absolutely dry numbers of times. In 1903 it was dry practically all the time, except during these flood times when we have the Purgatoire coming down or some of those streams up there. The stream from Pueblo when they have a rise there hardly ever affects us as far as we are.

When I first came to Hamilton county we had such a thing as is known as the June rise, and we generally had more water when the snow melted in the mountains than at other times. The June rises in those years lasted three or four weeks. They came and went
1788 gradually. It sometimes comes down in a three or four foot wall. It comes all at once and goes all at once. I never could see much difference in the early years upon the saturation in the bottom lands in Hamilton county. The water stood about the same in the land all the time. During the last ten years prior to 1904 it has been quite a little lower than it was then. The underflow is lower by a foot and a half to two feet. The underflow has a perceptible current through Hamilton county. That has been my observation. It is from west to east. I have seen it flow through a post hole, parallel with the river. It would clear from the
1789 upper side of the post hole, clearing toward the east. This underflow extends clear back to the hills.

I have been raising alfalfa since 1889. I seeded my crop in the spring of 1889 and commenced cutting on the fourth of July. As to the effect of the decreased flow of the river and the falling off of the underflow upon my alfalfa crops, my alfalfa crop is practically gone. I don't know as it is altogether the decrease in water, but I lay a good deal of it to that. This is also true of other alfalfa throughout the county. We haven't had until this year nearly as good hay as we used to have years ago. I attribute this falling off in the alfalfa and the hay crops to the fact that we haven't got so much water.

I do some irrigating. We began to irrigate in 1885, and I
1790 continued that until I left the farm five years ago. Not the same farm, though, all the time. From 1885 to 1890 there was a sufficient flow of water in the river to supply all our needs for irrigation during those years. For the last few years, excluding 1904, we have had very little irrigation except in flood times when the water comes down, a big rain out west or something of that kind. In the summer time we get very little except in flood times when there is a big freshet up west. The effect this lowering of the underflow has had upon our crops that we raise by irrigation has been that we do not raise half the crops that we used to. Our crops are very uncertain. We can't rely upon sufficient water for irrigation purposes for the raising of a crop.

We began to notice this diminution of the water in 1888 or 1889 or 1890—along there. It commenced to get less and has gradually been getting drier ever since until this year we have had
1791 more water. We get our water for irrigation from the Arkansas river.

The principal ditch in Hamilton county is the Alamo ditch, and there are several small private ditches. There was a little private ditch that three or four of us built in 1896. I own a part of it. The Alamo was built in 1888 or 1889. I think the first water turned into any ditch in Hamilton county for the purposes of irrigation was